DOCUMENT RESUME

ED 154 235 CE 016 080

AUTHOR	Page-Valin, L.; And Others
TITLE	Effectiveness of Driver Education: What Do We Know and Where Do We Go from Here? TIRF Issues in Road Safety.
INSTITUTION	Traffic Injury Research Foundation of Canada, Ottawa (Ontario).
SPONS AGENCY	Insurance Bureau of Canada.
PUB DATE	Jun 77
NOTE	115p.
EDRS PRICE	MF-$0.83 HC-$6.01 Plus Postage.
DESCRIPTORS	*Driver Education; Evaluation Criteria; Literature Reviews; Program Effectiveness; *Program Evaluation; *Research Methodology; Research Needs; *Research Problems; Traffic Accidents; Traffic Safety; Young Adults
IDENTIFIERS	Canada; United States

ABSTRACT

In its evaluation of the effectiveness of driver education as taught in secondary and commercial schools, this report (1) investigates the objectives of driver education, (2) determines what is presently known about its effectiveness through a review of previous evaluative research, (3) discusses what driver education is likely/unlikely to accomplish, and (4) specifies cost-effective directions for future research by priority. To provide a framework against which the research was considered, Section II divides the objectives into two groups, conceptual and procedural, and discusses the two main flaws in the methodology of previous studies: the characteristics of course participants and the instruments used to measure their performance. The conceptual objectives in the first part of Section III include acquisition of the principles of driving and the development of safe driving attitudes; the procedural objectives in the second part of this section relate to performance measurement judged in terms of road tests (intermediate criteria) and the number of accidents and violations (ultimate criteria). For each objective this section gives a definition and then evaluates the research methodology and its inherent limitations. Since none of the studies thus assessed is found to give definitive information about the effectiveness of driver education, Section IV examines two ongoing programs that seem well-designed and suggests new directions for research efforts. Besides an annotated bibliography, this document contains in two appendixes tables summarizing evaluation research and statistics on fatalities among young drivers. (ELG)

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ED154235

ISSUES IN ROAD SAFETY

JUNE 1977

EFFECTIVENESS OF DRIVER EDUCATION:
WHAT DO WE KNOW AND WHERE DO WE GO FROM HERE?

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ERRATA

The following errors unfortunately appear in the final printing of this report. Please substitute the appropriate year when applicable.

1. Page 9: Bishop, 1972 should read Bishop 1974
2. Page 12: Asher (1969) should read Asher (1968)
3. Page 28: (Barret, 1972;...) should read (Barret, 1973;...)
4. Page 32: Harrington (1971) should read Harrington (1970)
5. Page 40: (New York University, 1969) should read (New York University, 1968)
6. Page 40: Porter, 1976; (2 places) should read Porter, 1972

ACKNOWLEDGEMENTS

This research was supported by a grant from the Insurance Bureau of Canada.

The opinions, conclusions and recommendations expressed in the report are those of the authors and do not necessarily reflect the views of the funding agency.

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ABSTRACT

This report is based on a study of the effectiveness of driver education. The report deals primarily with methodological considerations critical to evaluation research and reviews the relevant literature in the area. The report focuses only on the *absolute* effectiveness of any formal instruction; it is not concerned with the relative effectiveness of different types of programmes. Because this report deals with research already conducted, it does not address the issue of what driver education may *potentially* achieve. The concern is, therefore, not with speculations about the effectiveness of expanded hours or expanded "quality" programmes. It addresses the issue of what research tells us at this point in time about the effectiveness of driver education.

This report addresses a difficult topic. It is difficult not only because the underlying research issues are complex, but because the area of concern is vested with considerable emotional attachment. It is likely, therefore, that the reaction of those who "believe" in driver education may be *prematurely* negative. Such reactions are understandable and predictable. But, a rational judgment of the report can be achieved only after it has been examined carefully. Although it may be tempting for persons with different interests to refer directly to the section(s) of the report which address their concerns, such a practice is dangerous and to be discouraged. The report builds upon issues and methodology and a complete appreciation of the implications of each section is to be gained only by progressing systematically through the preceding material.

EXECUTIVE SUMMARY

I INTRODUCTION

Formal driver instruction has proliferated in Canada in recent years. Commensurate with this expansion and the ever-increasing benefits accorded to course graduates, concern has been expressed about the effectiveness of the programmes. This is reflected in the plethora of effectiveness evaluation studies in the area. But these attempts to evaluate effectiveness have provided contradictory conclusions. This is so partly because the complex question of effectiveness contains within it the seeds of rivalry of two schools of thought representing driver "education" and driver "training". But, the present report is not concerned with the relative effectiveness of instruction offered in the secondary schools compared to what is given in commercial schools; it addresses a more fundamental issue, namely, the absolute effectiveness of any formal programme concerned with the preparation of the beginning driver for the highway system.

The current report is basically a review of the research conducted in the area of the effectiveness of formal driver instruction. The *purpose is to ask penetrating methodological questions of previous research in order to identify unequivocal conclusions about the effectiveness of driver instruction.*

II OBJECTIVES AND METHODOLOGICAL CONSIDERATIONS

Evaluation research can proceed only in the presence of clearly stated objectives. If there is a consistency in the area of formal driver instruction, it is in the diversity of stated objectives. The current report has adopted the position that, despite the numerous and even contradictory goals, it would be necessary to evaluate all those objectives which appear to be more important, or at least salient.

Methodology is of central importance to the validity of any research study. Thus, although the findings of early evaluation studies concluded that formal instruction was effective in reducing the collision rates of trainees, such studies were of questionable validity. Two factors are of prime importance to the validity of studies in the area of driver education: the characteristics of the course participants, and the measuring instruments used to determine performance. Because driver instruction has often been evaluated by comparing a group of students who have chosen to take the course, to a group who has chosen not to take the course, it is highly improbable that the differences in performance found between the groups can be attributable only to the driver instruction course. In fact, research evidence strongly indicates that those who choose to take driver education are different, as a group, from those who choose not to participate in formal instruction courses. The other variable of importance in driver education research is the measuring instrument used to evaluate the performance of subjects. The potential sourses of contamination, including test reliability, subjectivity, social desirability, and the like, are considered in detail in the report.

III EFFECTIVENESS OF DRIVER EDUCATION/WHAT DO WE KNOW?

This section evaluates a number of the stated objectives of formal driving instruction. Each objective is defined, followed by a discussion of relevant methodological problems associated with its evaluation and finally, the effectiveness of formal instruction as evidenced by any methodologically intact research with respect to that objective will be considered. Recommendations are presented.

A. Conceptual Elements of Formal Driver Instruction.

1. Acquisition of the Principles of Driving.

In this section, knowledge of driving refers to possessing theoretical information about the principles of operating a motor vehicle. It is viewed as one of the most fundamental objectives of driver education. The factor most likely to contaminate investigations on the acquisition of the principles of driving is the characteristics of the course participants. For example, students who enroll in driver education courses have higher levels of knowledge (as shown by appropriate tests), even before the formal driver course. Accordingly, any differences that exist after exposure to a formal instruction programme may be attributed, in part, to precourse characteristics. Only one study is provisionally accepted as evidence of the effectiveness of formal instruction courses, in changing the level of knowledge about the driving task. But, plausible rival hypotheses are advanced to explain even the results of this work. In effect, it is shown that a situation can be conceptualized where driver education might be shown to be less effective than no formal instruction, inasmuch as characteristics of the students are a potent determinant of scores on the tests, independent of exposure to the programme. The question of whether the principles of driving may also be acquired during the practical elements of instruction is addressed and results seem to suggest that experience strengthens basic knowledge about driving.

The only conclusion that can be given with some confidence is that there exists no unambiguous evidence of the effectiveness of formal driving instruction in producing knowledge about the principles of driving. It appears that vehicle operation is associated with the more long-term retention of information, but the reasons for this remain speculative.

2. Development of Safe Driving Attitudes

Formal driver instruction has been seen by many as being designed to foster safe driving attitudes in beginning drivers, thus leading to good traffic citizenship. Apart from the complexities of providing stipulative definitions of attitudes as well as appropriate measuring instruments, the initial attitudes of the students and the effects of social desirability are additional contaminating factors in definitive research. For example, initial attitudes, i.e., the characteristics of course participants, may influence the results of a study, since students selecting to take formal instruction have been shown to be generally more intelligent, to possess more general knowledge, to be more conforming, less gregarious, and finally, to have more socially normative attitudes. Apparent post-course differences between formally and informally trained are contaminated by such differences.

The results of studies designed to evaluate the effectiveness of driver instruction in developing safe driving attitudes indicate that no significant changes occur in the attitudes of drivers following exposure to formal courses. These findings are, in part, attributable to the lack of validity of attitude tests used. One study, however, used a valid test, but no changes were found in the attitudes of the students. Thus, driver instruction does not seem to change significantly the attitudes of graduates of the course. But, the specification of the attitudes on such tests puts severe limitations on the results. It is emphasized, however, that the limitations are imposed upon research and not created by it. If advocates of a programme maintain that certain objectives or outcomes can be expected from the course, then the onus is upon them to specify how such outcomes are to be measured.

B. Procedural Elements of Formal Driver Instruction.

1. Intermediate Criteria.

A critical determinant of the effectiveness of formal driver instruction is whether it adequately prepares the beginning driver for the highway system. This effectiveness has been determined often, by the performance of beginning drivers on road tests (called intermediate measures of performance) before much practical experience is gained. In this specific area, there has been virtually no research that has compared the performance of individuals receiving formal instruction to that of individuals who did not receive formal instruction. Although some research has compared the initial performance of beginning drivers to their performance at completion of the course, such research gives no information on the absolute effectiveness of driver instruction. Several methodological problems are associated with existing and potential research on intermediate criteria, two of which are given special consideration, namely, the previous driving experience of the students, and the driving experience acquired informally, during the course of formal instruction. Different students possess varied amounts of previous driving experience prior to formal instruction. This will influence the skills acquired during the course, as well as those that may be demonstrated at the end of the course. For example, individuals who did not receive formal instruction may perform as well on road tests as those who have received formal instruction; it may also be shown that individuals with greater amounts of driving experience opt not to take driver instruction. Such speculations are reinforced by research (e.g. Ohio Dept. of Education, 1974) which has shown that improvement in driving performance of subjects is a direct function of the initial level of skill. The gains appear to be more important for those with low levels of skills at the outset, but they are still the lowest group at completion of the course. A second source of methodological contamination originates in the driving experience that students gain outside the formal instruction. Empirical evidence indicates that those who gain more informal driving experience pass their licensing tests faster than those who gain less driving experience.

It is concluded that, the effectiveness of driver instruction in providing those skills necessary for efficient travel within the highway system is indeterminate.

2. Ultimate Criteria.

The issue of the effectiveness of driver instruction in reducing the crashes and violations of young drivers, remains critical. But methodological problems related to the task of evaluating this particular effectiveness are many, and their effects crucial to the validity of such research. One methodological problem relates to the characteristics of course participants; and it is described with specific reference to ultimate criteria. Furthermore, methodological problems exist in the use of driver records, including the human decisions behind the reporting and recording of a collision, as well as the differences in the records due to sex, age, and occupational level of the individuals. Other factors that influence the occurrence of a citation include the geographical area of residence of the driver and driving exposure. The geographical area of residence may influence a record, in the sense that different law enforcement agencies operate with different degrees of strigency. The driving exposure (e.g., how much driven and when) of a particular driver will influence the probability of being apprehended for a moving violation, irrespective of enforcement practices. Despite the multiplicity of methodological problems, the evaluation of the effectiveness of formal driver instructions with respect to its ability to reduce the number of collisions and violations of course participants has been the most fertile area of research in driver education. The current report reviews only those investigations initiated after 1970, to avoid redundancy with previous reviews of literature and in the hope that more contemporary research is more methodologically sound.

There is one well controlled study which investigated the effectiveness of driver education in reducing collisions and violations (Raymond, Risk and Shaoul, 1973). Preliminary results on the long-term effects of formal instruction courses indicated that no differences in collisions per mile were found between a group of drivers trained formally and another group trained informally. In conclusion, the ultimate effectiveness of driver instruction has yet to be investigated definitively. Preliminary findings from one good study, indicate that no difference exists between the accident experiences of formally trained versus informally trained drivers.

FUTURE DIRECTIONS/WHERE DO WE GO? RECOMMENDATIONS:

The major conclusion from the literature review is that no definitive information exists regarding the effectiveness of driver instruction in achieving many of its objectives. Although it may seem reasonable to suggest, therefore, that additional research efforts be marshalled immediately to study these objectives, it is uncertain that this approach is warranted since even recent work has, in many cases, failed to heed the methodological shortcomings identified and articulated in previous research. Furthermore, several major, well designed studies are underway. Additional research would seem redundant.

Recommendation 1. Further evaluation research on the effectiveness of driver instruction should be curtailed at least until the results of ongoing studies are available.

It also follows from the ambiguous nature of the available evidence that:
Recommendation 2. Any plans for the expansion of formal driver instruction programmes, especially those which are similar to already evaluated ones, should be carefully scrutinized.

If, however, some major curriculum changes are viewed as necessary, it is suggested that:
Recommendation 3. Proposals for substantive curriculum or content changes be viewed as *pilot* programmes and accompanied by independent, effectiveness evaluation.

Previous and ongoing research has proceeded in a highly similar vein so that new approaches and methodologies have been rare. In this section, a new approach to research in the field is suggested. Such work is based on the assumption that, if the concern is with reduction in injuries and damage, then the countermeasure design should be predicated not only on an intuitive feel and analytic examination of what needs to be learned to drive without error, but also upon an evaluation of what driving errors still persist, and under what circumstances and for what types of drivers.

Recommendation 4. Pilot research be initiated to determine the feasibility and practicality of "error-analysis" research.

Such work would be designed eventually to determine consistencies in the circumstances and errors of newly licenced drivers that lead to crash occurrence. Such data would provide essential feedback to trainers about features of programmes that require modification.

I. INTRODUCTION

In recent years, our society has witnessed the development of two highly related phenomena: the increasing involvement of young drivers in traffic crashes (Goldstein, 1972; OECD, 1975; Pelz and Schuman, 1971) and the rapid expansion of formal driving instruction courses - driver education. Viewed in this context, formal driving instruction is seen as a primary preventive countermeasure, inasmuch as it seeks to prepare the young driver for the highway system.

A. WHY EVALUATE THE EFFECTIVENESS OF DRIVER EDUCATION?

The rapid proliferation of formal driving programmes attests to the belief that they are effective. In Canada, formal instruction is offered in all provinces in one form or another, has become a requisite for licensing before age 18 in Saskatchewan, and graduates of driver education courses can benefit from reduced insurance rates. *Given such developments, it seems reasonable at this point to ask if the effects of driver education warrant continued expansion of the programmes as well as the associated advantages given to course graduates.*

Numerous attempts have been made to evaluate the effectiveness of driver education, but a review of the relevant literature fails to reveal consistent conclusions. Rather, it is replete with contradictory statements regarding programme effectiveness. Such statements have been formulated in different ways over the years, contingent upon who the evaluator was (e.g., primarily a proponent of driver education), public attitudes at the time, and the availability of financial support. Some have maintained that driver education *must* be effective because exposure to any formal instruction produces improvements. Others have concluded that formal instruction has no effect; while still others have even argued that driver education cannot be evaluated. Which position is correct? To answer this question, *it is imperative that the existing plethora of studies on the effectiveness of driver education be considered* *with respect to the validity of their findings, so that the implications of these findings for the future of driver education in Canada can be articulated.* Such is the primary purpose of this report. Although some comprehensive research efforts in this field have, in part, addressed the existing data (e.g., the Ohio Department of Education, 1974; the NHTSA study by Riley & McBride, 1975) these research reports have not been intended primarily as exhaustive reviews. Nor have the recent evaluative summaries of OECD (Driver Instruction, 1976) or NHTSA (DEEP Study). In the latter case, the primary focus was on the ultimate criterion of effectiveness; reduction in violations and accidents. The present review is, however, designed to address the issue of effectiveness in the broadest sense. Some driver educators have argued that ultimate criteria may, indeed be inappropriate indicators or, at least, an examination of them without regard for the other objectives of formal instruction (e.g., development of safe driving attitudes) is unfair. This report seeks to remedy that shortcoming.

B. EDUCATION VS. TRAINING

Formal driver instruction has its roots in two basic disciplines. One of these, the education system, has had a profound influence on the history of driver education. It is generally assumed that the education system teaches not only specific skills, but learning strategies, attitudes, motivation and the like, which generalize to other tasks. It is, therefore, not surprising that classroom instruction would form a major part of driver education in the secondary schools and it follows also that the assumptions of what it can accomplish would be similar to those held about the education process in general. The other discipline from which formal driver instruction has evolved is that oriented toward the practical features of manipulating the vehicle, where the relevant perceptual-motor responses are taught in the car. The basic assumption is that, "you learn to drive by driving, not reading about it". This approach has been labelled "training".

Thus, driver *education* is generally assumed to designate classroom instruction, while driver *training* is assumed to refer to the more practical aspects of a beginning driver's preparation for the highway system, i.e., the manipulative experience with a motor vehicle or simulator, in a driving range or on the road. Taken together, the concepts of education and training "cover the process of bringing a learner driver from *ab initio* to a level of skill and knowledge sufficient for him to..."properly operate a motor vehicle within the highway system (OECD, 1975). Although it may be argued with some validity that there is a distinction to be made between the educative and training aspects, it is generally agreed that complete preparation of the future driver involves both.

Unfortunately, the basic concepts of *education* and *training* have become mired in the controversy concerning the *relative* effectiveness of formal driver instruction offered by the secondary schools compared to that offered by the commercial schools. This is certainly not intended to suggest that the secondary schools practice education alone and that commercial schools practice only training although many have asserted such a position.

W. Rumsfield, addressing the National Driver Education and Training Symposium held December 1-4, 1968 for the public and non-public schools and January 26-29, 1969 for the commercial driving schools, provided a quote from the book, "The Highway Jungle", by Edward Tenney, which serves to illustrate the polarized feelings:

> " High School Driver Education is spiritual, theoretical, complex, academic and begins with the assumption that the student is ignorant of cars, traffic problems, and human errors.
> Professional Driver Training, physical, practical, unacademic, begins with the assumption that the student already knows much and should be trained or "habituated" to use that much well."

This controversy continues today and is exemplified by the dialogue surrounding the "California Driver Training Education Study" (Jones, 1973). Some 12,000 students were studied in this project at a cost of about $300,000. Three sets of criteria were used to judge the relative effectiveness of secondary school driver education compared to that offered by the commercial schools. The criteria used were training variables, licensing variables and citations and accidents on driving records. The authors concluded that: commercially trained students were somewhat superior on most training variables; commercially trained students scored significantly higher on the Department of Motor Vehicles' road test, although the actual difference was small; and, there was no difference in accident rate between publicly and commercially trained students. Given the *overall minimal differences in effectiveness of the two systems*, commercial training was regarded as the reasonable method of choice, because it was less costly. But, this did not prove to be the bottom-line. In 1974, a report was prepared for the California Committee for Traffic Safety Education by Leon Goldstein in which he reviewed the "California Study" of M.H. Jones cited above, and re-analyzed some of the data. His general conclusions, although not strikingly dissimilar from those of Jones, et al. did contain some essential differences, illustrating the relative superiority of secondary school training. Subsequently, Peck and Jones (1975) responded to Goldstein's reevaluation and took issue with many of the points. Goldstein (1975), in return, responded to Peck and Jones. The latter were unconvinced as revealed in a letter to the Editor of the Journal of Traffic Safety Education on July 28, 1975 from Herman Sillas, the Director of the California Department of Motor Vehicles. The arguments and disputes are for the most part statistical in nature and need not be considered here. The point is that, *historically, education versus training has been extended to mean secondary school versus commercial school.*

Such a dichotomy is, at best, artificial and for purposes of the present report is of little functional utility, since this report will address the issue of the *absolute effectiveness of any formal instruction.* The extremes rarely exist and the distinction, if it can be substantiated at all, occurs more in terms of different amounts of the variables along a continuum. The two are interdependent, as shown by research findings which indicate that knowledge of driving acquired during theoretical instruction is strengthened by the addition of practical instruction, and that both phases seem necessary for a proper initiation of the beginning driver to the highway situation (Bishop, 1967; McDole, 1974; Ohio Department of Education, 1974; Pain, 1973). The present report adopts the position that there is little to be gained by maintaining a firm distinction between education and training. Accordingly, any or all of the potential benefits to be derived from the systematic process of learning to drive through classroom, simulation, in-car, etc., are reasonable outcomes to be evaluated. The present report is, therefore, *not* oriented toward a consideration of the relative merits of education versus training as practised by the secondary schools or commercial outlets. It addresses a more fundamental issue, namely, *whether any form of instruction that relates to formal driver instruction produces unequivocal effects that warrant the tremendous resources devoted to it either directly in the form of programmes or indirectly in insurance premium reductions.* Accordingly, *in the present report, driver instruction is viewed as incorporating all the activities generally included in the formal preparation of the young beginning driver.* It encompasses, therefore, classroom instruction, simulator instruction, in-car observation, behind-the-wheel instruction, on the road or on a multicar off-street driving range. But, it will *not* refer to training for specialized vehicles, nor will it normally be used to refer to defensive or improvement driving courses.

C. PURPOSE OF REPORT

Given the preceding definitions and limitations, the aims of this report are to: investigate the *objectives* of driver education;

determine what is known at present about the effectiveness of driver education, through an in-depth review of the evaluative research devoted to the subject; discuss what driver education is likely-unlikely to accomplish; and, specify cost-effective directions for further research, within a priority framework.

The central purpose of this report relates to evaluating the effectiveness of driver education, but an essential precursor to that aim is an explication of the objectives of formal driving instruction. As will be seen later in the report, such an undertaking is mandatory, inasmuch as objectives and evaluation research are interdependent. Thus, once a set of objectives are established, the research literature germane to these objectives will be examined.

In view of the multitude of existing research in the area, not all studies will be discussed in detail. Rather, general findings, methodological considerations and limitations will form the core of the report with a detailed review of the most representative and/or important studies. Future directions for research in driver education will be suggested, as will the benefits to be accrued from the pursuit of such endeavours. Feasibility considerations as well as priority questions related to these research efforts will also be examined. It might well be argued that all research efforts should be curtailed until 1982, when the mammoth evaluation research project of the U.S. National Highway Traffic Safety Administration reaches fruition. As will be seen later, however, such is not the primary conclusion of this report, which indicates other profitable avenues of investigation that address qualitatively different issues than research efforts heretofore.

In sum, the present report will attempt to answer the following questions:

1. What is the effectiveness of driver education as determined from valid and reliable existing research in the area?
2. What supplementary information needs to be gained?
3. How can this necessary information be attained?

II. OBJECTIVES AND METHODOLOGICAL CONSIDERATIONS

In this section, the aims of formal driving instruction are discussed, since the process of evaluation effectiveness is intimately related to stated objectives. Then, some methodological issues germane to the evaluation of driver education will be considered.

A. OBJECTIVES OF DRIVER EDUCATION

The purpose of evaluation research is to investigate, empirically, whether or not a programme is effective; in other words, to determine the extent to which the programme achieves its stated objectives. The first task of the evaluator is, therefore, to identify the objectives of formal driver instruction. Identification for such purposes requires, however, more than a listing of generalized ideals. For research purposes, specific, quantifiable objectives must be delineated, inasmuch as it is impossible to determine whether or not the stated goals have been realized, if these aims are given in general terms. Unfortunately, specification of the objectives of driver education is not straightforward, since the aims of formal driving instruction are often stated in general, disparate, or even contradictory ways.

Despite such difficulties, the exercise of identifying objectives raises a salient issue. It makes evident that formal driving instruction has more than one purpose - *that is, there is no single objective of driver education.* Yet, the question addressed most frequently to researchers is, "*Does driver education work? It is effective?*" It should now be evident that *to ask such a question is naive, at best. But, what is more appalling is the unqualified readiness of devotees in the field to provide difinitive statements about the magnitude of effectivness, without any consideration for the multiplicity of potential objectives encompassed by their sweeping endorsation.* There are, in fact, almost as many objectives as there are individuals in the field and it is most unlikely that any programme can achieve a multiplicity of purposes for which it is not intended.

Part of the explanation for the variety of aims ascribed to driver instruction resides in its historical antecedents; education and training. Given that the schools of thought possess what is sometimes a radically different philosophy of instruction,it follows that their objectives of driving instruction will differ in terms of clarity, specificity, consistency and acceptance. Indeed, the discussion below substantiates this expectation.

Driver education was initially established on the principle that if better training were given to beginning drivers, better driving performance would be observed, especially in the early phases (Goldstein, 1971). Accordingly, better performance on the road was thereafter considered a justifiable goal of formal driving instruction. Good driving performance can, however, be defined in different ways. In fact, the interpretations are virtually as numerous as the individuals associated with formal driving instruction. Some instructors have defined good driving performance in terms of driving and manoeuvering skills (Goldstein, 1971). Others have set objectives that are more psychologically and civically oriented, the intent being to produce not only competent drivers, but ones who possess the right *attitude* toward safety and who demonstrate good *judgment* before they take to the road (Alberta Government, 1976). Thus, the objectives of driver education have come to include: changing attitudes (Barnett, 1973), inciting youngsters to develop good "traffic citizenship" and making them use the highway "safely" (Hartman, et al., 1972). Such objectives speak to socially desirable ends, but like the term "freedom", they lack specificity. How does one measure good traffic citizenship? And, if it cannot be measured, how can one tell if the objective has been realized? These issues will be returned to later, but in the present context it is clear that safety oriented objectives have been partly responsible for the evaluation of economically-related objectives, i.e., the objective of reducing the number and severity of traffic crashes as well as the number of violations. Thus, accident and violation reduction have been seen by educators as a desirable end to pursue and by highway safety representatives as a primary goal of driver education (Bishop, 1972; Conger, n.d.; Harman, 1969; New York University, 1968).

From the foregoing, it is clear that the objectives of driver education are manifold and diffuse. This point is dramatically illustrated in a quotation from Kelly (1971), who considers driver education not as a modifying or improving process, but as a potential *practice in thinking*: "(Driver Education)....may not necessarily change behaviour or improve manual skills, but does offer its subjects an intellectual and informational framework for thinking and making decisions about problems in the real world". Such zealous supporters appear convinced that driver education can accomplish virtually any objective. Other more pragmatically oriented persons may see survival value in changing objectives in response to different economic and social demands. This chameleon-like character of the objectives of driver education makes the evaluation process complex because the researcher's task initially is to specify which of the seemingly endless array of objectives are to be examined.

The present report has coped with this problem by restricting the evaluation to those objectives, which by consensus in the literature appear to be regarded as important or, at least, salient. The evaluation is, therefore, not exhaustive, but selective. Yet, the selection covers a wide range of objectives, which, for purposes of convenience, have been organized under "conceptual" and "procedural" headings. The "conceptual" elements involve those aims that relate generally to the cognitive and attitudinal objectives of driver instruction, such as, the acquisition of knowledge about the driving task, the development of safe driving attitudes, as well as good traffic citizenship. The "procedural" elements of driver instruction involve those objectives that are measured by road tests as well as by accidents and violations. Clearly, the distinction between conceptual and procedural objectives is arbitrary and, to some extent, artificial, yet such a dichotomy does provide a useful framework around which the research literature can be organized.

For purposes of continuity, a standard format will be adopted in the evaulation of each objective. The objective will first be defined, that is, specified in terms of the way it has been measured in previous research. Then, methodological problems associated with such research will be described. Finally, studies, if any, that have overcome these methodological weaknesses will be considered.

In view of the importance of methodology to the validity of a research study, the next section provides an overview of several of the major issues.

B. METHODOLOGICAL CONSIDERATIONS

The results of early studies designed to evaluate the effectiveness of driver education concluded unanimously and prematurely that the courses were effective in reducing the collision rates of trainees (American Automobile Association, 1955; 1959; Association of Casualty and Surety Companies, 1955). Reading only the *conlcusions* of such previous work is insufficient and misleading, for conclusions are interpretations of results and, often, many interpretations can be placed on the same findings. It is, however, also inappropriate to overlook the conclusions and examine, independently, the results of the research, subsequently, drawing one's own inferences. The critical error in this tactic is the acceptance of the validity of the results without a careful appraisal of the methods and procedures used in obtaining them. Accordingly, *a review of research designed to evaluate the effectiveness of driver education cannot be restricted to results and conclusions alone, but must ask penetrating questions about the methods as well.* What follows, then, is an examination of some relevant methodological issues to provide a general framework against which the studies on driver education will be subsequently examined. The most salient methodological features relate to the internal validity of the studies, i.e., the extent to which the results obtained may be attributable to the programme (e.g., driver education) or to other uncontrolled factors. The internal validity of studies in the area of formal driver instruction has been most seriously affected by two variables: characteristics of the course participants; and, the criteria against which the performance of participants are evaluated, i.e., the measuring instruments.

1. Characteristics of Course Participants

Basically, the effectiveness of driver education could be shown by demonstrating the existence of a *causal* relationship between formal driving instruction and the achievement by course participants of the specified objectives of the programme. Two research designs can be followed to this end. One design relies on a comparison of the performance of a group of drivers who have *chosen* to take formal instruction with that of a group of individuals who have chosen *not* to take it. This approach has been widely used. A second, approach *determines*, on some random bases, which students receive instruction and which do not, and then, observes the performance differences between groups. At first glance, the two procedures seem similar enough but, an important difference exists between them. The difference lies in the amount of confidence one can have in the *causal* nature of the relationship, i.e., in the extent to which the results are due to the driver education course itself rather than to other factors. The second research approach described above allows for greater confidence that observed performance differences are a consequence of the *manipulations* (exposure to driver education or no exposure) of the researchers. This approach has been used rarely.

The first procedure, such as, comparing the citation records of graduates of driver education with those of drivers who did not participate in the course, does not produce strong causal inferences. In this latter case, the assignment of the subjects to treatment conditions is not manipulated by the researcher; the subjects have already chosen to participate, or not in formal driving instruction. This procedure, termed *control by selection* results in a comparison of groups that probably differ systematically not only in terms of driver education, but also in terms of other factors, such as motivation, which may have profound effects on subsequent driving performance. *The difficulty is that any observed differences between the groups may be attributable to something other than driver education.* For example, there is evidence that differences do exist between students who choose to participate in formal programmes and those who decide not to participate. The Manitoba Department of Highways (1973) compared the driving records of a variety of students who had attended schools, in which driver education was offered. The students were all licensed within the same period. One group of these had completed a driver education course, one other group had expressed the desire to take the course, but was not able to participate in it, and a third group was not interested in, and did not take the formal driver instruction courses. The records of these groups were compared after a period of three years. Results showed that 24% of the first group (driver education) had some citations (convictions, accidents, department actions, or accidents with convictions); of those who desired to participate but were not able to take driver education, 38% had some citations; 62% of those in the third group had some citations. The critical group is the second one, *which did not have benefits of formal training*, yet its drivers had records that were appreciably better than those who did not want and did not take driver education. Hence, persons who wish to participate in formal training courses can be expected to have better driving records *even if they never get the formal instruction.* The implication is obvious. It is not meaningful to compare the subsequent performance of persons who elect to take driver education with that of a "control" group of students who who do not take driver education. The performance differences can, in part, be ascribed to initial "predisposing" factors rather than the effects of the course. This "predisposing" aspect has also been studied by Asher (1969), who investigated personal characteristics, which differentiate those who participate in a driver education course from those who do not, when such courses are available. Using data from paper and pencil tests previously administered to about 400,000 senior high school students, Asher correlated "sociopsychological" variables with the decision to take a driver education course. Of the 70 variables selected for study, 11 were found to be significantly related to the decision. These variables clustered around academic knowledge, intelligence, socio-economic status and socio-economically related activities, with the persons taking driver education being loaded to the more positive ends on all factors. Personality-linked variables were also observed to be related to the decision to participate in formal driving instruction. In this context, Rainey et al. (1961) found that course participants were more introspective, sensitive and submissive than students not following driver education.

Thus, there is clear evidence to support the thesis that initial differences do exist between groups who choose to take or not to take a formal driving course. Consequently, any differences observed in the subsequent driving performance of such groups could be attributable to factors other than the course; factors, such as, personality, socio-economic or academic variables.

To overcome the inferential weaknesses inherent in such research designs, experimental research procedures are viewed as a desirable alternative. Such methodologies rely on an unbiased assignment of subjects to treatment conditions. In this way, no potential contaminating or predisposing factor determines who receives driver education and who does not. Subjects in the various groups can be considered approximately equivalent at the outset, so that any differences that occur subsequent to the course can be ascribed to the formal driver programme. But, experiments have been rare, largely because ethical considerations prevent their usage. To select a group of students and provide half of them with a driver education course, which *may* be found to be effective, will mean that those not participating in the programme will be exposed to greater risk in their driving experience. Nevertheless, necessary social experiments have been conducted in other fields (e.g., Meier, 1972) and have grown in frequency in the area of driver education. Indeed, in the work of Riley and McBride (1975) and the subsequent ongoing NHTSA evaluation research, a randomized methodology has been approximated.

2. Performance Measures

The internal validity of studies on driver education has been affected not only by characteristics of the course participants, but also by the methods used to measure the performance of participants. Any attempts, research or otherwise, to determine the effects of driver education must make use of measuring instruments, i.e., some quantified system for determining attitudes, motivation, driver skills, accident rates, or whatever is selected as the criterion of achievement. In the area of research on formal driver instruction, the measuring instruments have generally been of two types: writeen tests and driving performance tests.

Written tests are generally used to evaluate the driving *knowledge* and the driving *attitude* of subjects. Such tests must be *valid* (proven that they measure what is intended) and *reliable* (the results can be replicated). They must be administered in the correct fashion (i.e., according to the standards that make them valid and reliable) to avoid contamination of results. Since the tests are usually administered before *and* after completion of a driver education course, the tests have to be designed in such a way as to prevent minimal bias from a previous administration. That is, exposure to the first test may sensitize the students so that they give particular attention to features of the course germane to those items included in the test. Thus, subsequent performance would be attributable to transfer effects from the first testing. This situation is best exemplified by a study. Seals (1966) investigated four formal instruction programmes to determine which produced better student achievement in driving knowledge. No significant difference was found in scores on the test of knowledge *before* training for the groups, but the post-test showed a significant improvement for each group. The conclusion that all programmes produced an improvement in knowledge cannot be accepted, because previous exposure to the test may have influenced the subjects in ways not investigated by the author. What is lacking in the study is a *control* group to determine the effects of such testing. For example, if one group was *not* pre-tested, but was tested after the driver education course, any differences between this group and the others on the post-test would be, in part, attributable to the carry-over effects of repeated testing. The use of a control group is only one potential design solution. For example, parallel forms of the tests might be used.

The second measuring system generally relates to evaluating actual driving performance. Generally, these systems take the form of observational schemes used to judge the correctness or accuracy of various vehicular manipulations. Frequently, such observational procedures rely upon the *judgments* of a trained observer using a preestablished rating protocol. This protocol may involve a check-list, with the task of the judge being merely to mark whether the various manoeuvers, that have been identified for study, were performed correctly or incorrectly. Although such approaches appear to be objective and free from bias, only the careful design and use of these rating systems can lead to reliable and valid data. There are two salient problems. The first involves how adequately the performance categories are defined as well as how explicit are concepts like correct and incorrect. A considerable amount of subjective evaluation can enter into the decision as to whether a response is correct or incorrect, unless precise parameters have been established defining what those two concepts mean. The point is that considerable work must go into the development of the measuring instrument that is used to evaluate driving performance; the listing of a number of reasonable performance responses together with the posibility of ticking them either correct or incorrect is far from desirable.

The second critical feature of such observational or judgmental procedures relates to their subjectivity. The ratings can be influenced by many variables including contextual factors and characteristics of the persons being judged. Reliable rating procedures, i.e., those in which the categories have been adequately defined and shown to be used in a consistent fashion, are less subject to such influences. But, unexpected factors can have rather profound influences on the performance evaluation. The results of work by Riley and McBride (1975) are illustrative of this problem. They examined consistency among judges when they were aware of the characteristics of the people they rated. The judges were driving instructors and they were rating performance on a road test in terms of general manoeuvers as well as in terms of specific performance variables. If all judges exhibited perfect agreement in their ratings, the reliability of measurement would be 100%. In fact, reliability was high: 92% for the ratings of driving manoeuvers and 88% for specific performance variables. Such reliability existed, however, when the *subjects* being judged were also driving instructors. But, when the subjects being rated were students, the reliability of ratings (for the same judges) dropped to 84% and 83% for overall and specific performance, respectively. That is, judgments were apparently influenced by *who* was being rated.

Measurement problems also exist for what are called ultimate criteria, defined in terms of such variables as accidents and violations. Again, because of the apparent objectivity of such measurements their use would not appear to be particularly problematic. However, even such criteria have difficulties associated with them. Collision rates, although undoubtedly a suitable criterion of the effectiveness of driver education, suffers from potential biases in the driving records. Not all collisions are reported, and therefore, they do not appear on a driver's record. Research in the area has suggested that whether or not a collision or violation is reported depends upon a number of variables, including the sex of the driver, age, and socio-economic status. Previously, in the current report, it was shown that people who take driver education are different from those who do not, in terms of several of the preceding variables that relate to whether or not a collision is reported. So, the differences in the collision rates as recorded on driving files may be more directly attributable to the characteristics of the subjects themselves than to their having been exposed to formal driving instruction. This particular problem will be returned to in considerable detail in a subsequent section of the report. Suffice to say at this point, that even the apparently simplistic criterion of collision records does have problems in its use. Again, studies that use such criteria without examining the factors or variables that determine the occurrence of such events on a record are open to serious criticism and the validity of the study is questionable.

In sum, the foregoing section was designed to illustrate a few of the more common methodological difficulties that exist in research studies aimed at evaluating the effectiveness of driver education. The discussion is by no means exhaustive, for it is intended to be illustrative. But the methodological difficulties illustrated are the ones most common to the research to be described in subsequent sections and provides a frame of reference against which the research reports will be considered.

III. EFFECTIVENESS OF DRIVER EDUCATION/WHAT DO WE KNOW?

In this section, a number of the objectives of formal driving instruction are evaluated. The primary purpose is to determine through a critical review of previous research, the effectiveness of driver education in achieving its stated objectives. Objectives are arbitrarily classified as Conceptual or Procedural. The Conceptual objectives include acquisition of the principles of driving, the development of safe driving attitudes, as well as good traffic citizenship. Procedural objectives relate to performance measure judged in terms of road tests as well as accident and violations criteria.

Each objective will initially be defined and, then, the relevant research considered from the standpoint of methodological limitations. In most instances, those methodological issues will relate to the material discussed in the preceding section, namely, characteristics of the course participants and the method used to measure performance. Finally, if any studies exist that have circumvented the major procedural difficulties, they will be considered in an effort to provide some unequivocal indication of the effectiveness of formal driving instruction in achieving the objective under consideration.

A. CONCEPTUAL ELEMENTS OF FORMAL DRIVER INSTRUCTION

1. Acquisition of the Principles of Driving.

In this section, knowledge of driving refers to possessing theoretical information about the principles of operating a motor vehicle. In some respects, it can be called "textbook knowledge". Although one feature of such knowledge pertains specifically to information about "safe" driving practices, this particular component will be treated separately in a subsequent section.

Clearly, the acquisition of information about the driving task is one of the most fundamental objectives of driver education. Unfortunately, some advocates of the "classroom" system are so committed to the basic assumptions of the educative process, that they accept *a priori* that this objective will be realized: "If you teach the material, it will be learned". But the extent to which the information is indeed acquired needs to be determined empirically, and this empirical task will be approached, in the current report, by a critical evaluation of the research relevant to the topic. Accordingly, this section will examine, first, the methodological problems associated with research on the acquisition of the principles of driving and then, determine if any methodologically sound studies exist that bear on the topic.

a. Methodological considerations. The most straightforward approach to determine the effectivness of driver instruction in teaching the principles of driving is to administer a reliable test of knowledge at the conclusion of the course. In this way, the absolute level of knowledge of each student can be appraised. Such an approach does not, however, address the question of the course effectiveness, since the initial level of knowledge the students bring to the course is not known, and the actual gains cannot be assessed. Accordingly, early research in the area used a simple pre-test (before the course) versus post-test (administered after the course) comparison. These comparisons were almost unanimous in their findings; the driver education students scored higher on the post-test of knowledge about the principles of driving, therefore, driver education courses were seen as being effective. But, even these data are unacceptable evidence about course effectiveness and the reason for this resides in the contaminating influence of the *characteristics of course participants*. Such influences became evident when researchers began to use control-group versus experimental-group (driver education) comparisons. In the process of these investigations, the crucial role of characteristics of the course participants is well revealed, as illustrated in an investigation by the Ohio Department of Education (1974). As part of a larger study, a combined knowledge-attitude test was administered to 1,500 students (1,000 of these were enrolled in driver education; 500 were not). The pre-test showed that, on the average, the group enrolled in driver education scored higher than the control group on all but one pre-test. This exception was a subtest on "knowledge of automobile" on which male control students scored as high as those in driver education. The critical point is the *overall pre-course* superiority of those who were enrolled in formal instruction. Basically, these results suggest a prime difficulty in determining the effectiveness of formal driving instruction in imparting knowledge about the principles of driving. Differences in knowledge exist *at the outset* between those who choose to take driver education and those who do not. But, the problem is even more complex, since the Ohio study also showed that *general knowledge and academic ability* was positively related to general *traffic* knowledge. The implication of such a finding is that the very abilities and attitudes that foster learning are more prevalent among course participants. Accordingly, any differences that exist after exposure to a driver education programme are contaminated by pre-course differences and exacerbated by those characteristics that contribute further to learning, *independent* of what is taught.

Similar pre-course characteristics were found by Pain (1973) when he evaluated an advanced driver education course. His driver education subjects did have higher knowledge scores *after* the course, but, on the average, they were older and better educated than the control subjects. Again, the point is that characteristics of the individuals who choose to enroll in driver education, such as, better general knowledge and better academic ability, affect not only the initial level of information possessed about driving, but also bear directly on the level demonstrated at completion of the course. Consequently, any study which does not control explicitly for these factors cannot be accepted as empirical evidence of the programme's effectiveness.

Indeed, most of the studies that have shown positive effects of driver education have failed to control adequately for pre-course differences among those who choose to take driver education and those who do not.

b. Effectiveness. Clearly, the studies reviewed thus far do not provide unambiguous evidence of the effectiveness of driver instruction in achieving the objective of teaching the principles of driving. Serious methodological limitations restrict the validity of the research. However, at least one study (Ohio Department of Education, 1974) did provide some insights, despite the initial differences in level of knowledge on the pre-tests. The logic of the approach was simply that, if driver education is effective, then the magnitude of the difference on the post-test between the controls and those in the driver education course should be greater than the magnitude of the initial difference. That is, the exposure to the course should enhance the already existing difference in knowledge. In fact, results of the post-test indicated that the driver education group made more substantial gains than the control group, on the post-test. Thus, driver education appears to teach knowledge about the principles of driving to its course participants. But, the authors noted that *there were also significant increases in the scores of the control group,* from the pre-test to the post-test (with the exception of a subtest on the application of physical principles).

Two hypotheses may be advanced to explain the control group's improvement. The first suggestion relates to the potential personal interactions between the experimental group and the control group. If the two groups are not isolated from one another, as was the case in the Ohio study, the students in the control group may increase the knowledge by discussing the course with the participants. A second hypothesis is that general informational sources related to driving became more salient for any student at these ages and that they acquire the information informally. Such possibilites have not been investigated.

Nevertheless, *the crucial point is that the increase in amount of knowledge of those in the driver education course was greater than that of those who were not in the programme.* Although it would be convenient to let the issue rest on that point, it would not necessarily be accurate. It may be recalled that the students enrolled in driver education possessed capacities that seem to foster learning. It is, therefore, indeterminate: (1) how much information such a group would acquire informally, i.e., if they were the controls; and, (2) how impressive the gains of the control group would be under formal instruction, i.e., they may gain no more formally than they do informally.

Indeed, it is not difficult to conceptualize a situation where driver education might be shown to be less effective than no formal instruction, inasmuch as characteristics of the students are a potent determinant of scores on the tests, independent of exposure to the programme.

The preceding studies have focused on the acquisition of principles through *classroom experience*. An equally valid and interesting question is whether such principles are acquired during the more practical elements of instruction. Bishop (1967) assigned students to one of four groups; three were experimental and one was a control, with all groups receiving pre-test on knowledge about driving. There were *no* significant differences in pre-test scores. The experimental groups then received behind-the-wheel instruction and observation time, with one of these groups receiving simulator instruction in addition. All students received a post-test after the course was completed. Two of the experimental groups showed reliable increases in knowledge while the third experimental group declined slightly. Of greater interest, the control group retrogressed substantially. In comparison to the control group, therefore, the experimental groups all showed positive effects and two of them increased in knowledge relative to their initial level. It is to be stressed that the gains occurred in the presence of the manipulative aspects of instruction (i.e., the vehicle operation phase), suggesting that such operations also serve to strengthen basic knowledge about the principles of driving. Such interactive effects of knowledge and experience were also evidenced in the follow-up portion of the study by the Ohio Department of Education.

Although they found that the number of in-car sessions had little effect on the acquisition of information about driving, one year later, they found a positive relationship between knowledge and amount driven. Apparently, the practical features of vehicle operation reinforce basic knowledge of driving. The potential explanations for this are manifold and largely speculative.

In this context, a related issue is the length of time that the knowledge, apparently acquired in driver education courses, persists. The retention, it could be argued, need last only as long as the driver licensing test; but most instructors would agree that the goal of teaching is to instill material that is retained far beyond such immediate objectives. This feature was investigated by Vilardo, Blumenthal and Planek (1968) and by the Ohio Department of Education (1974). The Ohio study examined the retention of knowledge and found that after a one year lapse, information measured by their test was still retained; but, the best retention of knowledge was shown by those subjects who drove more during the year, illustrating, as suggested above, that practice extends the length of the retention period. Vilardo et al. (1968) also investigated knowledge acquisition and its stability over six and twelve month periods, but in a defensive driving course. The findings indicated that the effects of the course on retention of knowledge were not consistent. After six months, knowledge scores were better for those who took the course than those who did not, but no differences were found between the groups after a period of twelve months. These findings may be relevant only to advanced training courses, where additional knowledge is taught. Nevertheless, the results provide an indication of the length of time knowledge acquired through formal training might be expected to be retained.

c. Conclusions. In summary, a number of studies have been designed to evaluate the effectiveness of driver instruction in teaching information about the principles of driving. The results of very few of the studies can be accepted as meaningful, however, because contaminating variables such as self-selection, academic ability and general knowledge may be partly responsible for the gains indicated. Notwithstanding these factors, at least one study made use of a control group and did verify that the increase in level of knowledge of the driver education group was *greater* than the increase of the control group, during the same period of time. However, even in that work it is unclear that the gains shown would necessarily be expected for students other than those with characteristics that are associated with choosing to take formal instruction. The results are confounded by such factors, precluding any conclusive remarks about programme effectiveness. Indeed *the only conclusion that can be given with some confidence is that there exists no unambiguous evidence of the effectiveness of formal driving instruction in producing knowledge about the principles of driving. It does appear that vehicle operation is associated with the more long-term retention of information, but the reasons for this remain speculative.*

2. Development of Safe Driving Attitudes.

Advocates of formal driving instruction have often contended that the course promotes safe driving attitudes in beginning drivers. The assumption is that if the proper attidues are fostered, they will be translated into appropriate judgment and behaviours on the highway. That is, safe driving attitudes lead to good traffic citizenship. Indeed, some have even argued that overall good citizenship practices can be engendered by safe driving attitudes. Clearly, the crux of the basic issue resides in the extent to which the fundamental safe driving attidues are effectively transmitted in formal driving instruction.

As in the previous section, a definition of driving attitudes will be followed by a consideration of the methodological difficulties associated with studying the phenomenon. Finally, the effectiveness of driver education in achieving this particular objective will be considered in the light of any methodologically reliable research.

Proper driving attitudes have been considered an important factor in the operation of a motor vehicle for many years. The concept of attitude has been variously defined and not all definitions have had similar reference. In fact, the definitions have been as manifold as the psychological theories of their authors. Generally, however, there is agreement about basic components of attitudes: (1) they are considered more or less to have an emotional basis, (2) they are acquired from personal experience, and (3) are as many and as varied as the situation to which they are a response (Haddon, Schuman and Klein, 1964). Driving attitudes, by extrapolation, can be considered as a structured, somewhat emotionally based, learned response to the driving situation. Given such a general statement it is to be expected that there is no single accepted definition of driving attitudes. That is, attitudes will be measured in different ways by different researchers. It follows that "good traffic citizenship" will also be difficult to measure. Inevitably, this imposes critical limitations on the probability of effectively assessing the impact of driver education on either driving attitudes or good citizenship.

a. Methodological considerations. The assessment of driving attitudes has been obtained generally from two sources: written tests and records of collisions or violations. The latter have been used as the ultimate criteria of driver education's effectiveness and will be accorded separate treatment in another section. Written tests have been used for immediate or intermediate evaluations of driver education effectiveness, usually administered before and after completion of a formal instruction programme; the objective being to determine if driver education has had a positive effect on the attitudes of course participants. Even if it can be assumed that valid tests of attitudes are feasible, such testing procedures are still subject to other sources of contamination. In addition to the general difficulties of pre- and post-testing students (discussed previously), there are two other factors pertinent to the investigation of attitude change: the initial attitudes of the students which, again, addresses the issue of characteristics of course participants; and, the effects of social desirability.

The initial attitudes of the students may contribute substantilly to the confounding of results of investigations in this field, especially in cases where driver education courses are not mandatory. It was previously stated that students who choose to participate in driver education programmes are different, as a group, from those who decide not to participate in a formal instruction programme. Voluntary participants have been shown to be generally more intelligent, to possess more general knowledge, to have better academic ability, to be more conforming, less gregarious, and finally, to have more socially normative attitudes. There are, at least, two possible consequences of such attributes. The first is that students with such attributes would tend to be more positively influenced by a driver education course than individuals who are less conformist, more outgoing, less bothered by social desirability and the like. A second possible consequence is that, given that the attitudes of the students who elect to participate in formal instruction programmes are positive in the first place, the potential effectiveness of driver education is dimished, since the valence of the attitudes is almost maximal at the outset.

The effect of social desirability creates an additional contaminating factor in the determination of attitudes. This concept is reflected in the tendency of students to answer questions in a way that makes them appear socially desirable; i.e., they respond in a way they believe is acceptable, not necessarily on the basis of what they actually think. For example, a question on drinking-and-driving may well be seen as potentially threatening. Because of the fear of repercussion, the students may state that they disagree with such behaviour, while, in fact, they do not necessarily disagree. Thus, social desirability would produce "good" driving attitudes, although such results are not a true representation of the students' real attitudes. It should be evident that this issue is particularly relevant to the attitudes of students in driver education, because such individuals generally possess more compliant, normative characteristics. Accordingly, this increases the probability that they will show changes in attitudes, apparent or real.

Hence, notwithstanding the validity of attitude tests, such tests are subject to contamination from the initial attitudes of the students as well as social desirability.

b. Effectiveness. A number of studies have been designed to evaluate the effectiveness of driver education in developing safe driving attitudes (Ohio Department of Education, 1974; Bishop, 1967; Pain, 1973; Riley and McBride, 1975). The results of the majority of the studies indicated that *no significant* changes occurred in the attitudes of the drivers following exposure to a driver education course. Various explanations have been given by the authors for these results, but generally the responses relate to the lack of validity of the attitude tests, the high, positive initial attitudes of the students, as well as social desirability.

The Ohio Department of Education (1974) did find that the attitude test they developed was related to driving behaviour, but that these attitudes were *not significantly affected* by existing driver education courses.

No statistically reliable attitude changes were found in the study by Riley and McBride (1975) either. Nonetheless, the authors analyzed the shifts in attitudes between the pre-test and post-test of the two experimental groups. These changes suggested a shift toward a more realistic, less overcautious driving attitude as a consequence of the course. Although potentially interesting, the implications are indeterminate inasmuch as the students' attitudes from the beginning are positively related to safety.

In view of the difficulties associated with the assessment of driving attitudes, as discussed above, and the apparent inability of formal instruction programmes to influence these attitudes, Bishop (1974) advocated a values-clarification approach. This approach is designed to help the students: (1) understand how personality traits influence driving performance; (2)

analyze their own personality for tendencies that facilitate and those that interfere with competent and responsible driving; and (3) develop a plan for cultivating desirable tendencies and eliminating or compensating for undesirable ones (Bishop, 1974). Such an approach, although not having been evaluated by investigators, does illustrate new directions in driver education. The investigation of intrinsic personality factors and their relationship to driving behaviour are seen by some as a more reliable method of evaluating the effectiveness of driver education (Barret, 1972; Goldstein, 1962).

c. Conclusions. In conclusion, then, *driver education courses do not seem to change significantly the attitudes of graduates of the course.* But it cannot be said that the programme is ineffective, since the attitude tests are generally not valid and it is unclear whether the tests are a reflection of the initial attitudes of the students or are a result of social desirability. It should be stressed, however, that *these limitations are imposed upon research and not created by it.* As mentioned before, *if advocates of a programme maintain that certain objectives or outcomes can be expected from the course, then the onus is upon them to specify how such outcomes are to be measured.* The posture of the researcher is, in this respect, unbiased. He/she is prepared to evaluate any objective, but must insist that the goals be specified in a quantifiable fashion. Otherwise, the objectives are no more than a will-o-the-wisp; functionally as useful and equally intangible.

B. PROCEDURAL ELEMENTS OF FORMAL DRIVER INSTRUCTION.

1. Intermediate Criteria.

A critical determinant of the effectiveness of formal driver instruction is whether it adequately equips the beginning driver with the practical manipulative capacities necessary in the highway system. This effectiveness has in some cases been determined by the performance of these drivers on road tests, administered shortly after completion of the course. These road tests may be part of the formal instruction programme itself or may be a part of the test for driver licencing. The phrase, intermediate criteria, in this context, means that driving performance is usually measured before the driver gains much practical experience with a motor vehicle. It does not, therefore, reflect driving performance in the "real-world", but rather provides a potential index of the effect of the course on a short-term basis.

In previous sections, the methodological problems associated with the relevant evaluation research were considered first, followed by an examination of the effectiveness of formal instruction in achieving the particular goal under consideration. That structure cannot be maintained in the review of research on intermediate criteria. The reason for this resides in the lack of appropriate research. In previous sections, the principal concern involved determining the absolute effectiveness of driver education in achieving its stated objectives. That is, studies were considered in which the performance of individuals receiving formal instruction was compared to that of individuals who did not receive formal instruction. Unfortunately, there has been virtually no research utilizing intermediate criteria that has made such a comparison to permit, at least, some basic insights into the effectiveness of formal instruction programmes insofar as road test performance is concerned. Indeed, the overwhelming majority of studies have concentrated on a comparison of performance of individuals at the initial stages of driver education with the performance of those same individuals at the termination of the programme. Although such research may provide insights into the performance gains occurring during the programme, it does not address the questions of the absolute effectiveness of formal instruction, inasmuch as the crucial control group is omitted. Without a control, the implication of the results is totally equivocal.

Nevertheless, some of these studies will be mentioned here as will several of the relevant methodological problems associated with any research that is designed to utilize intermediate criteria of this type. The rationale is that such an exercise will focus on the complexities associated with potential research and will provide cautionary notes for future investigations.

Numerous methodological problems exist but there are two major factors that deserve special consideration: The previous driving experience of the students (again, characteristics of the course participants); and, the driving experience acquired *informally* during the course of formal instruction.

Different students possess varied amounts of previous driving experience prior to formal instruction. Past driving experience and, the related initial level of driving skill a beginning student possesses prior to a course may influence dramatically both the skills acquired during the course as well as those that may be demonstrated at the end of the course. Any research designed to compare the performance of control subjects with those who have received formal instruction must acknowledge this potential source of contamination. For example, it might well be shown that individuals *not* receiving formal instruction perform as well on road tests as those who have received formal instruction leading to the conclusion that driver instruction is *not* effective insofar as this objective is concerned. However, it might well be that individuals with greater amounts of previous driving experience are, in fact, the very individuals who opt not to take driver education. Accordingly, the comparison of the two groups is inequitable. This particular issue is also of concern in a comparison of the *relative* effectiveness of several different types of formal programmes as well as a simplistic examination of changes in performance in any one particular programme. That is, the gains made in performance may be totally contingent on the initial level of skills. Thus, one particular programme may be shown to be ineffective in changing performance. But, if the initial performance level of the course participants is exceedingly high, the opportunity for gains is considerably less (i.e., performance is near asymptote). Such a speculation has indeed been substantiated, in part, by research (Ohio Department of Education, 1974). In that study it was found that the improvement in driving performance of the subjects (i.e., the skills acquired and measured in the course) was a direct function of the initial level of skill. Individuals rated as having either low, moderate, or high levels of initial skill all showed improvements throughout the course of the investigation, but the gains were less for those with an initially high level, than those with an initially low level. Clearly, future work on the effectiveness of formal instruction that uses intermediate criteria measures must anticipate potential confounding from initial levels of experience.

A second major source of contamination arises from the driving experience that students gain outside the formal instruction provided in the course. As in the case of the previous methodological difficulty, a comparison of the road test performance of a group of students in formal instruction courses with that of a group who do not receive such formal instruction may produce equivocal results, if no estimation is available as to the amount of informal experience acquired. This becomes even more crucial in a comparison of various formal instruction systems. Thus, the relative effectiveness of two programmes that differ, say, in terms of the amount of classroom or behind-the-wheel experience, must take into consideration the amount of informal practice obtained by the participants. Assume that one of the programmes is shown to be associated with better road test scores. Careful examination may, however, reveal that the causal effect is not direct. For example, the apparently more effective course may stimulate students to gain experience outside the formal instruction and it is this increased extra curricular activity that leads to success. If such were the case, it would be inappropriate to conclude that the course, per se, was directly effective. The distinction is important, because those who are pre-occupied with matters of content and curriculum would be misdirected in their search for an explanation of the course's success. If differential amounts of driving experience are gained outside the formal training experience, the performance at the end of the course will be contaminated by such initial differences. Indeed, there is empirical support for such speculation. Harrington (1970) obtained information, by means of a questionnaire, on the amount of informal experience gained by students. Students were dichotomized in terms of the amount of informal experience; those who obtained more than 15 hours of informal driving practice and those who obtained less than 15 hours. It was found that among the top 10% of graduates from the driver education course, the pass rate on the first licensing trial was 81% for those with less than 15 hours of driving practice and 90% for those with more than 15 hours. Evidently, the amount of informal practice is associated with performance on intermediate criteria. Similar results have been reported in the study by the Ohio Department of Education (1974). So, future work must recognize the potential confounding associated with informal experience.

As suggested in the introduction of this section the evaluation of the intermediate effectiveness of driver instruction programmes in teaching the practical aspects of driving can only be accomplished by determining if the performance of graduates is better than that of drivers trained informally. In an effort to obtain some indication of the performance of course graduates on intermediate criteria, the pass rate of applicants for driver licensing tests may be examined. In the District of Columbia, 41-45% of *all* applicants failed the driving test on their first attempt (Goldstein, 1971; from the Department of Motor Vehicles, 1968, 1969). Yet, in California, Harrington (1971) reported that the pass rate for a group of graduates of driver education was 73%. It may be tempting to use such crude approximations as a suggestion that driver education graduates perform better on licensing requirements than do a general group of applicants. However, it must be kept in mind that such comparisons of pass rates are not necessarily valid for several reasons, including the fact that licensing procedures are not consistent. It is also worth mentioning in this context that passing a driver's test may indicate simply that due emphasis has been placed on those elements in the formal instruction programme that bear directly on the features of the driving test.

As suggested in previous sections, the ideal methodology for research in this area would permit the random assignment of students to experimental (formal instruction programme) and control groups with reliable pre-testing and post-testing. Unfortunately, no research has investigated the intermediate effectiveness of driver education using this method. In fact, the studies that have some bearing on intermediate criteria have evaluated only the performance gains of students in formal programmes (e.g. Ohio Department of Education, 1974). That is, no external controls have been used. Although such approaches may in some instances be useful for generating insights about course weaknesses and, thereby lead to the improvement of the course, they begin with the implicit assumption that the programme is, in fact, effective. *Logically, however, the absolute effectiveness of programmes should be addressed before improvements are considered and, as implied above, recent research on the absolute effectiveness in terms of intermediate criteria is notable only by its absence.* It follows that *no conclusion is feasible in this section regarding effectiveness of formal instruction in achieving intermediate performance criteria.*

2. Ultimate Criteria

One of the most enduring issues in the area of formal driver instruction is the effectiveness of the programme in bringing about a reduction in the involvement of course graduates in traffic collisions and violations. In effect, driver education instructors and highway safety representatives have established such a reduction in traffic involvement as *the ultimate goal* of driver education. The issue continues to be of importance primarily because young drivers are disproportionately involved in traffic crashes and violations, and driver instruction has been implicated as effective in reducing this involvement. As witnessed by the focus of past and ongoing research by NHTSA considerable resources have been devoted to this objective and the purpose of the present section is to evaluate previous research relevant to the effectiveness of formal driver instruction in attaining this ultimate goal. Prior to such an undertaking, the methodological problems likely to be encountered in evaluation research of this type must be considered, together with the consequences of such problems.

a. Methodological considerations. The purpose of the attendant discussion is to examine specific methodological questions that are related to the task of evaluating the effectiveness of driver education in reducing the traffic collisions and violations of course graduates. The first issue relates, again, to characteristics of the course participants and the second to the method of measuring the performance of course participants, i.e., the validity of using driving records as a criterion of the effectiveness/ineffectiveness of the course.

The first issue, the characteristics of course participants, has been shown to be a consistent methodological problem in research on other objectives of driver instruction. Indeed, the general problems have been considered in preceding sections and need only be reiterated here briefly. A comparison of the driving records of course graduates with those of persons who elect not to take driver education is contaminated by predisposing characteristics, such as, personality, attitude, motivation, and general academic skills, which differentiate persons who decide to take advantage of formal programmes from those who do not. Accordingly, any reliable differences detected in the citations or accidents of the two groups may not be attributable to the course, per se, but rather to characteristics which the course participants possess *before* formal instruction. But, the use of driving records as the criterion of performance is further complicated by the characteristics of course participants. As mentioned in a previous section, the *occurrence* of a citation on a driving record is related to characteristics of the person involved. This does not refer to the *actual* differential involvement of certain types of persons in violations or accidents, but rather to the likelihood that different types of persons are more likely to be cited. Thus, not only do course participants differ from non-participants in terms of variables that may lead to actual differences in crashes or other violations, but the very features that distinguish the two groups spuriously inflate the likelihood of receiving a citation. That is, if differences exist between the driving records of participants and non-participants, several suggestions may be advanced to explain the difference: The difference was created by participation in a formal instruction system; the difference is attributable to personal characteristics that produce better drivers, irrespective of course involvement; alternatively, the types of people, who tend *not* to take formal courses, stand a better chance of receiving citations. Or, all three factors may be contributory. Most research in this area does not permit a disaggregation of these potential causal agents.

Collision involvement as shown on driving records, is not necessarily subject to simple reporting procedures, whereby any traffic crash, be it property damage, crash with injury, or fatal traffic crash, is inevitably entered on a driver's record. The probability of finding a particular event on a driver's record is contingent also on the *severity* of the collision. *Only a very small number of fatal* *collisions go unrecorded; by contrast, a much smaller percentage of property damage collisions are reported, and, finally, recorded.* This situation exists, in part, because of decision-making, which depends on the characteristics of the driver involved, and the police officer investigating the collision. The problem and its complexities have been well articulated by Zylman (1972):

> It would seem that "everyone knows" what a traffic "accident" is. However, the questions as to whether such an event should be reported to a police department, whether a policeman will appear at the scene to write a report, whether a police agency will report it to the DMV, whether such report should be limited to fatal and injury crashes or include collisions resulting in a specified amount of damage, or whether all collisions should be reported - these questions have almost as many answers as there are police agencies.

Collisions will only be entered in the records if the driver(s) involved decide(s) to report the collision to the appropriate agency. This decision, in itself, is arbitrary: if the driver at fault does not want to report a collision because of concerns about increased insurance premiums, he/she may simply attempt to deal directly with the other driver, avoiding a citation on his/her own driving record. Any driver is vulnerable to this situation; the young because it may affect insurance premiums, the old because it may lead to the critical level of demerit points. Notwithstanding this decision, even police officers on the scene of a collision may not report it in writing, if no injuries are involved (Zylman 1972), or if the damage is just over the amount fixed by the law to warrant reporting. Research findings tend to support these suggestions. For example, McGuire (cited in McGuire, 1969) found interesting biases in the driving records of 500 drivers (from a pool of 2,797) in the State of Mississippi. McGuire found that *the number of reportable collisions* (i.e., those where damage exceeds the minimum amount fixed by the state) *stated by the individuals themselves, as opposed to those actually on their record, differed as a function of the sex, age and occupational level of the person.* Thus, females had only 33% of their reportable collisions on record, compared to 66% for males; young drivers had 60% of their collisions on record, while 29% of the collisions of drivers over 31 years of age were recorded; unskilled drivers had 71% of their collisions on record, while only 33% of the reportable collisions of semi-professionals or professionals were recorded; and, 58% of the collisions involving students were recorded. Thus, biases are present in the recording of collisions on driving records. If these distortions were constant for all individuals, the effects would be predictable and, thus, controllable. But the biases are variable being contingent on factors such as age, sex, and occupational level. In addition, when the severity of the traffic crash is not high, the decision of the driver or the police officer will also determine if the crash will be reported and put on record. These factors, then, suggest that the validity of such records is not as certain as would appear superficially.

The use of traffic citations as a criterion of success is complicated further by variables other than those that originate in the characteristics of the driver. These factors include time, geographical area, and exposure.

The overall frequency of violations and accidents renders them a relatively rare event (Bishop, 1974; New York University, 1968) and it has been argued (e.g., Marek, 1974) that data must be accumulated for a period of four to six years before some degree of stability in accident data is achieved. Otherwise, small fluctuations, which may indeed be random, will have apparently profound effects on the comparisons. Thus, two approaches are available. Relatively small groups (several hundreds) of individuals may be followed, intact, for many years; or, very large groups (several thousands) may be studied for a few years. As a rule, the larger the period of follow-up after driver instruction, the better. Few studies have chosen adequate alternatives.

The geographical area in which a driver lives can also influence characteristics of the driving record. Assume that the violation records of two drivers living in different cities, were compared to determine which person were the better driver. If, for example, driver A had a better record than driver B, two conclusions may be equally valid. First, driver A may be the better driver or, second, driver B may live in a city where violations are strictly enforced. In fact, the second conclusion would probably be the more valid. Thus, a driver may have more or less violations on record, depending on the enforcement policies, practices and atitudes of the police department in that area (Zylman 1972). Evidently, knowledge of such contaminating factors will undoubtedly be of importance, especially in studies using aggregate data derived from disparate regions where different agencies may have different practices. The comparability of driving records originating from different areas may, therefore, be questionable.

Another complicating factor is called exposure. Goldstein (1969) described this concept as the inflationary effect of stable *qualitative* and *quantitative* differences in exposure of individual drivers to police observation. Quantitatively, a driver who travels yearly in excess of 10,000 miles is potentially exposed more to police observations than one whose average is less than 5,000 miles. In addition, exposure may be related to qualitatively different factors, such as, the type of vehicle driven, type of roads used and hours of driving. People who drive certain types of cars in times and areas of high police density are rendered at higher potential risk of apprehension. In fact, there may exist a cummulative relationship among these variables and the increased/decreased probability of receiving a citation. For example, although no research has investigated this relationship, it may be that "high-powered vehicles" are more susceptible to being observed, relative to speed, than ordinary vehicles. The probability of being apprehended for a moving violation is, therefore, contingent on how often and under what circumstances driving is done. *These factors are critical, because empirical evidence suggests that driver education graduates drive fewer miles than their informally trained counterparts* (Raymond and Risk, 1973; McGuire, 1969).

Thus if a graduate of a formal instruction course is found to have fewer violations than a driver trained informally, it will not necessarily signify that he is a better driver. He may simply have driven less often, thus being less susceptible to police observation and subsequent citation.

The factors described in this section represent some of the more salient and potentially uncontrolled variables, which may contaminate the violation records of drivers. If such factors are not controlled, the results of the research are open to plausible rival interpretations.

In sum, driving records, although being a suitable measure of the effectiveness of driver education, possess inherent biases related to the personal characteristics of the drivers and the practices of law enforcement agencies.

b. Effectiveness of the programme. Despite the enormity of the methodological limitations considered above, the most fertile area of research in driver education has been the *evaluation of the effectiveness of the programme with respect to its ability to reduce the number of collisions and violations of course participants.* The relevant studies are reviewed below to determine, if, in fact, the research has shown that driver education is effective in reaching this goal.

The current review of literature focuses primarily on research initiated after 1970, for two reasons. First, evaluative reviews have been conducted elsewhere on studies completed before 1970 (Dunlap and Associates, 1968; Goldstein, 1969; Harman, 1969; Kennedy, 1968; Lybrand, 1968; McGuire, 1969; New York University, 1968), and a reconsideration would be redundant. Second, it is assumed that research builds systematically upon previous work and the more contemporary research should be more methodologically sound. Thus, the discussion below will examine briefly the general findings of previous reviews of the literature, and, then, consider the limitations and implications of the findings of recent investigations.

The effectiveness of formal instruction in reducing the collision and violation involvement of young drivers has received considerable attention over the years. (Dunlap and Associates, 1968; Goldstein, 1969; Harman, 1969; Kennedy, 1968; Lybrand, 1968; McGuire, 1969; New York University, 1968). Apart from the study by McGuire (1969), which found that driver education was of no value in the reduction of citations to young drivers, the conclusions of all previous reviews of literature on driver instruction can be summarized as follows:

> No clear proof has as yet been produced showing that driver education, as presently constituted, has a significant favourable effect on driver performance. No clear proof has as yet been produced showing that driver education, as presently constituted, does not have a significant favourable effect on driver performance.
>
> (New York University, 1969)

This quotation has appeared in many publications and has been used to represent the *general* state of the art of the effectiveness of driver education at least prior to 1970. Accordingly, it must be determined if studies completed subsequent to 1970 have provided any different conclusion about the programme's effectiveness or ineffectiveness.

Although research done before 1970 stressed the need for the use of equivalent groups or, at least, matching techniques to control for potential confounding effects, only a few studies performed after that time have heeded the warning. Most research continued to compare groups on the basis of those who choose to take, or not, driver education (Manitoba Department of Highways, 1973; Wuerdemann, 1976; Porter, 1976; Harrington, 1972). But, in fairness to these studies, they did acknowledge and did discuss the limitations present in that type of research (Porter, 1976; Harrington, 1972), and still others effectively started with the explicit contention that students who choose to participate in driver education have indeed different characteristics, as a group, from those who decide not to participate in the course (Manitoba Department of Highways, 1973). However, acknowledgement of a limitation does not thereby eradicate the source of contamination.

The general finding of such investigations has been that driver education graduates are less involved in traffic crashes, than drivers trained informally. But, the validity of this finding is highly suspect in view of the alternative interpretations that can be advanced in light of the group inequities that existed (see the detailed discussion of characteristics of course participants).

There are, however, four other well known studies that warrant consideration (Pain, 1973; Raymond et al. 1973; Schuman, 1971; and Lyle, 1976). But, Pain (1973) investigated the effectiveness of advanced driver education courses, and the results are, therefore, not germane to this report. Furthermore, the sample of students was too restricted for any confident generalizations to be made. Schuman (1971) did investigate the feasibility of influencing crash involvement through intensive formal driver education sessions but, again, the number of students was so small (n = 19) that reliable conclusions cannot be drawn. A study by Lyle (1976) has been cited by many as showing that driver education is effective in reducing the involvement of young drivers in moving violations. But, the procedures used in that investigation preclude the unconditional acceptance of those positive results. The process whereby participants were selected is not identified and the number of violations for the driver education group is so low in one year as to suggest that alternative interpretations should be considered (again, see the discussion above on the use of such criterion measures).

There is, however, at least one well controlled study which investigated the effectiveness of driver education in reducing collisions and violations (Raymond, Risk and Shaoul, 1973). To remove elements of self-selection or volunteering, driver education courses were experimentally introduced into the curricula of the schools selected for study. Thus, each of the nine schools involved in the experiment was taken as an individual unit, where formal instruction was either provided or not provided. The experimental design further controlled for possible socio-economic biases by inverting the experimental status of the schools from one year to the other, during the three year period of the investigation. Thus, in the first year of the study, four schools comprised the experimental group, and five schools were the control group; in the second year, the status was reversed, and reversed, again, in the third year. This procedure had two positive effects: potential socio-economic biases were controlled, as was personal interaction between the experimental group and the control group. To test the hypothesis related to accident and violation reduction, biographical data, interviews, and questionnaire responses were gathered from the students. These provided the main source of information on collision and violation involvement of the subjects, but reliability checks were done on the driving records of those students who remained in the same geographical area. In all, approximately 1,800 students were involved in the investigation (900 in the experimental group, 900 in the control group). Because improvements were introduced in the second and third year of the project, especially with respect to the quality of the practical training given to the students, the first year was considered a pilot study by the authors. Preliminary results on the longer term effects of formal driving instruction courses (i.e., involvement in accidents and violations) indicate that certain differences were found, but they were related to exposure-to-risk, and driving practices. Thus, the experimental group was found to drive less, drive less regularly, and drive less during the night. When the driving records of the groups were compared generally, the average driver in *the experimental group had fewer accidents than the average driver in the control group.* But, because of the differences in exposure cited above (e.g., experimental group drove less) the driving records had to be compared on the basis of accidents per mile. This comparison produced no differences between the experimental and control groups in terms of accidents. The only meaningful difference found by the authors was revealed in a comparison of accidents with injuries, for female students, in which the experimental group of females had fewer accidents with injury than the control group of females. The authors concluded that: "although the results of the follow-up studies for 1973 and 1974 have yet to come, the main conclusion to date from the study of longer term effects is that driver education in schools has little effect on the number of accidents".

c. Conclusion. In conclusion, the effectiveness of formal instruction as a preventive countermeasure to the involvement of young drivers in traffic crashes and violations has yet to be investigated definitively and the final results of the NHTSA study to be completed by 1982 will be interesting in this respect. Preliminary findings from one reasonably good study, however, suggest no difference in accident experiences of formally trained versus informally trained drivers.

IV. FUTURE DIRECTIONS IN DRIVER EDUCATION/WHERE DO WE GO FROM HERE?

The preceding sections of this report have attempted to provide information on the state of knowledge about the effectiveness of formal driver instruction. The general conclusion is that there still exists no *definitive information about the effectiveness of driver education with respect to a variety of its objectives.* It might seem reasonable to suggest, therefore, that all the objectives of formal instruction still need to be evaluated and that investigations should be initiated promptly. Such work should heed the methodological considerations that have been a focal point of the present report. But, many of these methodological issues have been known for years, and despite this knowledge, investigations have continued to repeat the errors. Implicit in the preceding comment is the proposition that *the present section will not recommend for continued research efforts in the same ilk as the multitude of existing studies.* The present section will, however, examine a new direction for research in driver education. Prior to such an undertaking, ongoing research efforts will be considered.

A. SOME PRESENT RESEARCH PROGRAMMES

Given the lack of definitive information presently available on the effectiveness of driver instruction, current research efforts, by and large, have been designed to increase the level of information through methodologically more competent work. Two studies of interest are in progress; one of which is, again, concerned primarily with the ultimate effectiveness of the programme, while the other is concerned with both intermediate and ultimate criteria of effectiveness.

The first is a study being conducted in Prince Edward Island cooperatively between that province and Transport Canada. It is examining the effectiveness of driver instruction in reducing the collision and violation involvement of young drivers, using driving records as the criterion. Eventually, the study will use a preferred assignment procedure to create participant and non-participant groups. It is unclear, however, whether the adequate methodological precautions have been taken to ensure the validity of the measurement system (driving records). At least some of the difficulties will be nominalized through the use of a relatively intact geographical region (i.e., minimal number of persons to monitor, restricted and known road conditions, identifiable population characteristics, etc.) A further study, of major proportions, is being conducted through the auspices of the National Highway Traffic Safety Administration in the United States, based on a pilot study previously done for NHTSA by Riley and McBride (1975). The investigation is considering both intermediate and ultimate criteria. The study sample consists of approximately 18,000 students *invited* to participate in driver education programmes. These students are then randomly assigned to (1) the NHTSA-developed driver education programme (Safe Performance Curriculum); (2) a Pre-driver Licensing Course, and (3) to a control group which will receive no formal instruction. Thus, approximately 6,000 students are in each group with about 3,000 of these expected to complete the programme and to be licenced within six months of completion. The groups will be tested for intermediate performance, and driving records will be monitored for a period of two years (NHTSA, 1975). The goals of this ongoing project are first, to determine the potential crash and violation reduction of the Safe Performance Curriculum; second, to confirm the effectiveness of the programme in terms of meeting other objectives; and third, to establish the reliability and validity of short-term performance measures used in the study. The project is expected to be completed in December 1982.

While it is expected that the efforts of this latter project will provide new and meaningful information on the effectiveness of formal instruction courses, the future of driver education research, in the interim, must be examined.

B. IMPLICATIONS

Given the equivocal nature of previous work and the comprehensiveness of work in progress,

> *it is recommended that future evaluation research of the variety described in this report be curtailed*, at least until the results of the ongoing studies are obtained.

However,

> *it is reciprocally recommended that any plans for the expansion of formal driver instruction programmes be carefully scrutinized* given the lack of definitive conclusions on its effectiveness.

It is also

> *recommended that, if substantive curriculum or content modifications are deemed necessary, they should be introduced only on a pilot basis with effectiveness evaluation built-in.*

After-the-fact evaluation is difficult to conduct and, more importantly, any outcomes from such evaluation will carry less impact because the programme under study will already be regarded as vested and indigenous. That is, negative evaluation will have little practical impact. If, however, the programme is viewed in the first place as only explanatory, its demise can occur with more certainty and less disruption.

From a cost benefit perspective, it may seem reasonable that the alternative is not to curtail or limit expansion, but rather to discontinue completely existing formal instruction if, in fact, the advocates still believe that formal instruction's existance is determined by the objectives studies here. That is, there is no strong evidence of effectiveness, so "close it down". But from a social perspective, it must be realized that driver instruction is a firmly established institution in society. Thus, despite research findings about the effectiveness or ineffectiveness of driver education, such programmes are probably here to stay, at least until *dramatic* changes in economic resources force closure. This apparent compromise should not be taken to mean that social research is fruitless and cannot produce impact. Neither should it be interpreted as suggesting that social institutions are invulnerable to research findings. It does, however, suggest that modifications are more likely in those instances where a *new* programme is being considered or where an existing one is being changed. The posture must be adopted that any or all new programmes or changes are regarded as provisional and must be evaluated in terms of objectives. Given that driver instruction has assumed the position of a potent institution in society, can future research assume a role other than the "evolutionary monitor" role described above? In other words, where do we go from here?

C. FUTURE RESEARCH EFFORTS AND IMPLICATIONS: WHERE DO WE GO FROM HERE?

In view of the countermeasure orientation driver education has imposed upon itself, future efforts in the area of driver education should, perhaps, aim at increasing this countermeasure effectiveness.

Research efforts may, in fact, build on the basic premise from which driver instruction was initially established. Formal instruction, as discussed previously, was seen by many as the answer (countermeasure) to the over-involvement of young drivers in traffic crashes; its ultimate effectiveness would, then, be measured by a reduction in traffic crashes involving young drivers. But such effectiveness has often been determined by counting accidents or violations. Viewed in this fashion, the exercise appears somehow disparate with the countermeasure objectives. Perhaps the focus or level of analysis has been wrong. If concern is eventually *with a reduction of injury and damage, countermeasures must be based on what is known about the crashes of young drivers, the causes of the crashes, and the characteristics of the young drivers involved.* What is suggested here is that counting citations or accidents is not only frought with problems (recall the extensive methodological discussion in the previous section), but such an exercise may address the wrong questions. Instead, efforts should be made to identify the consistent features of the crashes of newly licensed drivers. That is, the crash occurrences of newly licensed drivers should be examined for consistent interrelationships among characteristics of the driver, vehicle and, the environment. For example, some research (e.g., Aaron, 1972a; Kimball, 1971) suggests that beginning drivers fail to integrate speed and control. Clearly, the importance of such an observation resides in the extent to which this driver limitation predicts crash involvement. What is suggested here is that from an analysis of the crash contingencies, one may identify recurrent patterns which inevitably may lead to suggestions regarding those elements of the beginning drivers repertoire that require special attention. In other words, there may exist a potential research system that can serve not only to strengthen the basic understanding of crash occurrence, but also can serve to guide countermeasure (e.g., driver instruction) development. But the feasibility of initiating such research and the probability of cost-effective results (feedback) depends on two factors. The first is the feasibility of correctly evaluating and identifying the crash dynamics of new drivers. This may be approached in at least two ways: by an *in-depth* investigation of all traffic crashes (crashes with injuries or fatalities), or by reference to police accident investigation reports. Clearly the reliability and comprehensiveness of the former are considerable, as are the costs. The latter approach, although less costly, may suffer in comprehensiveness and reliability. Some features of police reports appear comprehensive and reliable (e.g., road characteristics), but other aspects (e.g., those relevant to pre-crash dynamics) are less comprehensive and probably less reliable. Accordingly, initial research using such a measurement system must address the question of crash dynamics from an exploratory perspective (i.e., from the standpoint of general research payoff as well as the perspective of measurement reliability).

The second limiting factor is not methodological, but social. It involves the spirit of cooperation. Changes can be suggested and curriculum modifications proposed, but no alterations will occur unless driver instructors are prepared to accept the assumptions which underlie the approach adopted here. Basically, *the assumption is that all educative or quasi-educative systems are deeply concerned about the errors that students persist in making.* Presumably, instructors will acknowledge that *persistent* errors may, indeed, indicate weaknesses or shortcomings in the method of instruction. But, without such recognition and a spirit of cooperation, the functional utility and cost effectiveness of the research suggested above will be minimal.

In sum, formal instruction courses must be accepted as given in our society. But this does not mean that they can be considered immune to evaluation research or to improvements in quality. Significant future research payoffs are seen through investigations of the dynamics of young driver crashes, to determine, for example, if the crashes of young drivers are characterized by different circumstances than those of other groups of drivers, or, for example, if certain specific errors are over-represented in such crashes. While it is recognized that driver instruction courses can never provide all the necessary driving experience, it may provide an adequate base. That base should be established, in part, through a recognition of persistent errors that lead to crashes.

APPENDIX I: Summary Tables of Evaluation Research

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
AARON, J.E. et al. 1972a Driver Performance	N:85 High school graduates of driver education.	Multivariate analysis of driver performance	A. Derivation of two indices of performance: Vehicle speed factor, Vehicle control input rate. B. Knowledge of the identity of sex and linear combination of all demographic variables could predict performance index scores for females; not for males.	Feasibility study only, no generalizations to be made; the demographic variables chosen for study are of little value.
AARON, J.E. et al. 1972b Driver Performance	N:50 (M:29;F:21) High school graduates of driver education, chosen by their teachers on availability & willingness to participate.	Correlational analyses between driving performance & self-concept.	Significant correlations: a) Greater self-satisfaction & fewer accelerator reversals. (.76). b) High sense of personal worth and high number of accelerator reversals (-.56). c) High sense of personal worth and high number of steering reversals (-.62). d) High behaviour profiles and high number of speed changes (-.69).	Sample is small and biased, being under the general norms on the self-concept scale. Author recommends replication with larger sample.
ASHER, J.W. 1968 Driver Education	N:532; represents those who had opportunity of taking driver training in a 1% sample of the total population (797) I: Took II: Did not take.	Correlational analyses between taking/not taking driver training and 70 variables chosen for investigation (from 500 possible).	11 significant relationships were found, clustered around academic knowledge, intelligence, socioeconomic status and socioeconomically-related variables.	Causality is not established, only correlation; as with other correlational studies, the coefficients are low.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
ASHER, W. & DODSON, B. 1970 Driver Education	N:799; I:310: 10% of those who had 1+ accident in previous year; II:489: 1% of those with no accident in previous year.	Correlational analyses between having/not having had an accident and 103 variables; also, the accident criterion and taken/not taken driver education.	40 variables (22 for boys, 28 for girls) were significantly related with accident criterion. 4 of 8 variables were related to taking driver education; driver education was not sign. related to the acc. criterion; highest predictor was access to car & times per week drive car.	- only 1 year follow-up - causality not established because after the fact - low correlations.
ASHER, W. & DODSON, B. 1971 Driver Education	N:7996; total sample of "yes" respondents (I), with 10% of "no" respondents (II); question: had 1+ accident in previous year.	Correlational analyses between 377 variables and accident criterion; also between acc. and taken/not taken driver education, when available.	74 variables (40 for boys, 34 for girls) were sign. related to accident criterion; 14 variables related to electing to take driver education; driver education was not a predictor of accident involvement; highest predictor: access to car.	- no. of significant variables is less than chance expectation; same limitations as two previous studies.
BISHOP, R.W. 1967 Training Phase	N:200 (divided into four groups of 50) students from population of 1250 (chosen randomly).	Randomized design (selection and assignment) - pre and post written tests for all groups, incl. control.	-simulator instruction was sign. better than other means for acquisition of knowledge, not different for attitudes, and sign. better than traditional course on road test performance.	- interesting results, but the pure effects of simulator instruction were not truly tapped because behind the-wheel and in-car observation also included.
CALIFORNIA DEPT. 1973 Driver Education VS. Driver Training	N:12031 (out of 15010 drop-out rate of 20% -sample was randomly selected from random sample of schools in random sample of districts.	Randomized design with nesting of programmes into simulator or non-simulator districts.	-commercial school trainees had better immediate and intermediate performance criteria; no differences between public & commercial programmes in terms of accidents and violations -simulator programmes were better.	- the drop-out rate of 20% is of critical importance. - different standards for different schools

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
CONGER, J.J. et al. 1966 Driver Education	N:120;from 108(I), 195 (II), and 314 (III), three stratified, random samples were taken for a 2nd analysis, 40 in each group. I:wanted to take/took; II:wanted to take/unable; III:did not wish/did not take.	Ex post facto, post test only, two control groups design.	A. First analysis: Group I had sign. fewer violations than II or III, no differences in accident rates. B. Control by matching, 2nd analysis: group I had sign. fewer accidents than II or III, no diff. for points or violations.	Even if done after the fact, good investigation because controls introduced; but no generalizations are possible because of small N, and problem of regression to the mean.
CRANCER, A. 1967 Driver Education	N:1,600,000; no specific information is given on characteristics except type of training; the sample is made up of number of licensed drivers as of May 4, 1967.	No specific design; comparison, after the fact, of driving records of all drivers in the state.	-high school driver education better than commercial training which is better than no training at all.	- no confidence to be put in the data - basis for comparison is not acceptable - no controls.
GOLDSTEIN, L.G. 1974 Driver Education VS Driver Training	N:12031 (same initial sample as California Dept. Motor Vehicles but specific analysis only to those licensed at 6 mos. and then those licensed at one year.	Reanalysis of data presented in California study (Jones); specifically: sexes analyzed separately, also separately analyzed group licensed after six months and group licensed after one year.	-generally, public courses were found to have fewer accidents & violations than commercial courses.	- number of students in each cell may be too small for conclusions -districts being compared different (etc.). Those limitations were set by the author.
GREENSHIELDS, B.D. and PLATT, F. 1967 Driver Performance	N:140 (40:control group; 40:high-accident drivers; 20:high violation drivers; 40:beginning drivers.	With instrumented vehicle, investigated possibility of predicting future driver behaviour with the use Cont. on Page 4.	-important variables:traffic density; running time; acceleration reversals; gross steering reversals and fine steering rev. -correct classification achieved Cont. on Page 4.	- possibility of making false positive or false negative decisions - still, essentially a feasibility study, to Cont. on Page 4.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
GREENSHIELDS, B.D. and PLATT, F. (continued)		of specific variables found to be important.	in 66% of cases.	replicate previous findings - small number of subjects.
HARRINGTON, D.M. 1970 Driver Education	N:505 (initial N:587 but quest. received from 86%). The students were nominated by their instructors as capable of passing the driving test (Top 10% of pop. of course participants).	Mail questionnaires sent to determine if passed or failed 1st attempt, plus other variables & examination of driving record.	Total pass rate of first trial: 73% (all graduates) -pass rate for students nominated: 85% - > 15 hours driving experience: 90% passed on first trial.	- reliability of questionnaires -controlled for more information from instructors.
HARRINGTON, D.M. 1972 Driver Education	N:12,082 (No. on which driver training status was available.	Ex post facto research, follow-up period of four years -some analysis of covariance on biographical data to remove volunteer bias.	Results of section on driver training and driver education: -Education: reduced fatal and injury and partially-at-fault accidents for females. -Training: reduced all of the above in addition to single vehicle accidents (for females only).	Mentioned by the author himself: because ex post facto: difficulty of distinguishing corelation from causation. No definite conclusion.
KIMBALL, K. et al. 1971 Driver Performance	N:31 (experienced: 11; novice > 10 hrs. of driving experience:8; novice < 10 hrs.: 12) - all males.	-subjects tested on performance measures, once a week, in four consecutive weeks.	-experienced drivers:less error and greater degree of consistency than novice drivers. -speed control:experienced drivers maintained the most rapid rate of speed, while maintaining relatively consistent speed control, novice drivers less integration of both.	- very small N - no generalizations, but interesting trends.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
LYLE, K. 1976 Driver Education	N:1584: 792 driver education students and 792 non-driver-education students; matched on sex, age.	Probably after-the-fact, but not clear; violation offences taken from driver records; five year period, 1968-1973.	-driver education students received 82% fewer citations for moving violations than other group; driver education group received 83% fewer violations per person over the five year period.	- no interpretation of results is possible because sampling strategy and data are unclear; - the no. of violations for the year 1971-72 does not seem comparable to other years, but the author gives no explanation.
MANITOBA DEPT. OF HIGHWAYS 1973 Driver Education	N:913;Group I:573, chosen to take driver education; Group II: 83, wanted to take, not able; Group III:257, no interest in driver education courses.	Comparison of driver records after three years of driving experience.	-Group I: 24% had citations -Group II: 38.5% had citations -Group III:61.8% had citations.	- use of driver records may not be valid - no control for exposure -no generalizations.
McDOLE, T.L. 1974 Driver Education	N, for knowledge test scores: 1162 N, for simulator scores: 440 Four groups: A: before driver education; B: after driver education; C; before driver ed. with simulator; D; after driver ed. with simulator (students enrolled in driver education).	Knowledge: pre-post-test design (A → B; C → D), Simulator performance: post-test only (C → D).	Significant changes in scores: - A and B (knowledge) - C and D (knowledge) - B and D (knowledge) - C and D (simulator)	- pure effects not tapped because change in curriculum at same time - also all the students had behind the wheel training; this can contaminate the results.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
McGUIRE, F.L. 1972 Driver Education	N:2961;basic airmen & officer training candidates with two years of driving experience. Sample divided in a validation (N:1481) and a cross-validation group (N:1480).	Criterion: all accidents incurred by each subject; after the fact investigation; correlations and multiple correlations were done between biographical variables and the criteria.	-significant predictors in the validation sample: home values, population of home town, family income; with cross-validation: value of parents' home - driver education: cannot be utilized as a predictor.	- correlations do not establish causality - after the fact research.
McGUIRE, F.L. n.d. Driver Education	N:94 (47 in group I, classroom only; 47 in group II, classroom and behind-the-wheel) - groups matched on age, sex, father's occupation.	Comparison of reported accident involvement -correlational analyses between accidents and driver education.	-no difference found between the two groups on accidents or violations. - no correlation between accidents and driver education.	- ex post facto research - the initial number of subjects is different from the one on which the analyses were done - sample very small - no generalizations.
OHIO DEPARTMENT OF EDUCATION 1974 Performance Measures	-knowledge and attitude pre test: 1500 (1000 enrolled in d.e.; 500 not enrolled), post test (1346); year later, 599 experimentals. -performance test: experimentals: 57 (pre-post).	Pre, post and year later tests on knowledge and attitude;& pre-post tests on driver performance.	-knowledge: sign. gain in scores for the two groups, more for the experimental group. -attitudes: no sign. effect of driver education on attitudes -performance: errors reduced by a significant amount.	- no isolation between groups (i.e. knowledge, attitudes).
PAIN, R.F. et al. 1973 Advanced Driver Education	N:3276 (2,155 exp., 1,121 controls) Program I: 619 exp., 388 c. Program II: 806 exp. Program III: 730 exp. + 733 control for II & III -exp. & control subjects were matched. Cont. on Page 7.	Pre-post tests on knowledge, attitudes, driving range, and comparisons of accidents, exposure from questionnaires and driver records;also responses from behavioral questionnaires. Cont. on Page 7.	-comparison of programmes -no sign. differences on acc. rates and no. of accidents -injuries: sign. difference favoring Programme I (with controls).	- specific population may be different from general population.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
PAIN, R.F. et al. 1973 (continued)	-subjects: army recruits.	Program I: classroom and range Program II: classroom only Program III: range only.		
PELZ, D.C. and SCHUMAN, S.H. 1971 Young Drivers	N:2874 (respondents from a probability sample of suburban drivers) -young drivers:2156 -experienced:618	Personal interviews & official files were the sources of data. Analyses: x numbers of crashes, controlling for mileage, by multiple classification analysis.	-males 18-19 more crashes and violations -age is stronger predictor of crashes and violations than driving experience. -if learned at recommended driver education age of 15, peak delayed by one or two years.	- use of driver records although controlled by self-reports. - only 1 year is taken, can it be representative of control for chance occurrences? - big differences in number of cases, i.e. young vs. old.
PORTER, J.W. 1972 Driver Education	N:1531 (10% random sample of students born between 1951-1952 and who completed dr. ed. in 1967-1968; males only.	Ex post facto research comparison of 9 types of driver instruction programmes through driving records (moving violations, accidents with injury, property damage, and points accumulated.	Traditional programmes seen less effective.	- set by the author: no control group, probably not comparable groups, programmes; no control for exposure, enforcement, no statistical analysis done.
RAYMOND, S. et al. 1973 Driver Education	N:1800 (900 experimental; 900:controls)	Driver education introduced in curricula of 9 schools in a rotation fashion; First year: 5 control schools & 4 experimental schools; Second year: 4 control schools & 5 experimental, third year same as first - post tests on knowledge Cont. on Page 8.	Preliminary results: short term: trained students had better knowledge; intermediate: fewer trials on driver licensing; longer term: no significant difference between groups on accident rates when mileage is considered. - sign. fewer accidents with injury for trained girls.	- good study

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
RAYMOND, S. et al. 1973 (continued)		to experimental and control groups -follow-up 2 years on accidents & violations.		
RILEY, M.C. and McBride, R.S. 1975 Driver Education	N:1328 (experimentals enrolled in courses) N:903 (experimentals who completed the course) -no information on control students -invited to participate -Experimental groups: I:SPC, II:PDL.	Pre-post design for knowledge & attitude tests for the two experimental groups. -post test only for practical tests.	Knowledge: pre-post: improvements for the two groups (safe performance curriculum, pre-driver licensing). SPC had better scores. Attitude: course produced more realistic and less over-cautious responses, but not significant differences. Driving performance: SPC higher than PDL.	- students invited to participate, thus self-selection problems, - attrition rate is high from 16% to 53%.
RODDEL, M.J. 1969 Public vs. Commercial	N:521 (423 public courses; 98 commercial courses).	-comparison of driver records after the fact.	Males with private instruction had better records than those in public schools reaching significance.	- self-selection - no information on period of observation - very different sample size for public and private.
SCHUMAN, S.H. et al. 1971 Improved Driver Education (countermeasure)	N:133 (Group I, experimental:19; Group II, control: 114);experimental group randomly selected from 2500 students; matched on sex, grades in school, number of previous accidents and violations.	-submitted to 7-2 hour sessions in 7 weeks, then follow-up personalized letters: six months, 12 month criterion measure: two year follow-up of driver records.	Treatment group, continuous decline in crash rates; controls: increase in second six-month period, then gradual decline. -overall reduction after two years for both groups -no sign. difference in acc. rate per 100 drivers.	- crashes per 100 drivers with an N of 19 is misleading - equivalence of groups not ascertained.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures	Results, Conclusions	Limitations
SEALS, T.A. 1966 Driver Education	N:600 (150 in each of 4 experimental groups, no control group). Random assignment.	Four group pre-test, post-test on knowledge. Post-test only on performance. Groups: I: Classroom & behind the wheel, II: Driving range & class, III: Simulator, class behind-the-wheel, IV: Driving range, simulator, class, behind-the-wheel.	-significant difference in knowledge between pre-test and post-test. -performance: significant difference favoring I, III, and IV over II. Conclusion: ranges do not permit students to acquire many of the skills needed to cope successfully with opposable traffic.	- no control group - not mentioned if total population or driver education enrollees only.
SHIVELY, J.E. & ASHER, W. 1970 Driver Education	High schools: N:454 Students, N:798.	Correlational analyses 1) Characteristics of schools vs. offering/not offering driver education. 2) characteristics of students versus took driver education/did not take because not available.	1) Students: significantly related with not having opportunity to take driver education: academic knowledge, socio-economic status, socio-economic related variables. 2) Schools: characteristics related to not offering driver education: socio economic status - author mentions that not necessarily a cause and effect relationship.	Some general limitations as study by Asher (1968).
VILARDO, F.J. et al. 1968 Defensive Driving	N:155 (employees of electrical company) divided in 3 groups I: course volunteers: 62 II: non-course, volunteers: 14 III: non-course, non-volunteers: 79	Pre-test, post-test design;and additional post-tests at 6 mos. and 12 mos. after.	1. Effect of DDC on knowledge: improved knowledge, short-term; 6 months, also sign. difference favoring course participants; 12 months: no difference. 2. Effect of DDC on attitudes: sign. difference, favoring course participants, short-term six months: no difference; 12 months: sign. difference.	- effect of self-selection - from a pre-test table non-course non-volunteer group seems different to start with.

Author, Year Area Investigated	Sample, Size & Characteristics	Research Design, Procedures
WUERDEMANN, et al. 1976 Driver Education	N:13,679 (fatal crashes from Jan. 1973 to June 1974)	Ex post facto, comp rison of records, exposure, age on th basis of having tak not taken driver training.

Design, dures	Results, Conclusions	Limitations
cto, compa- ecords, age on the aving taken/ driver	- no differences in terms of sex, driver history, exposure. - age differences: 94% of those 30 years and over did not have driver training.	- after the fact study, use of driver records, no controls.

APPENDIX II: Recent Fatality Statistics On Young Drivers

It has long been recognized that young drivers are over-represented in traffic crashes and fatalities. This situation has led to considerable interest in the young driver population, especially with regard to the factors involved in their traffic crashes. Because of the recent interest generated in this area, this appendix presents some tables on salient aspects of the problem of young driver fatalities. Such information is presented herein, first, because of the direct relation between this group of drivers and formal driving instruction, and second, because it is felt that, only through comprehensive knowledge of young drivers and their particular involvement in the highway system, can effective countermeasures be developed. Accordingly, the tables in this appendix will describe briefly the population of young drivers to be investigated, and will then consider some exposure characteristics as well as alcohol involvement in the fatal traffic crashes of that particular population.

The tables presented below and the information they contain are the result of preliminary analyses on young drivers who died during 1974 and 1975. The data are part of a larger data set gathered by T.I.R.F., on which expanded information was available. The particular data for this study consisted of drivers, aged 11 to 24 years, of automobiles, trucks, vans, motorcycles and tractor-trailers. The fatalities occurred in four provinces: Alberta, Saskatchewan, Manitoba, and Prince Edward Island. A total of 447 young driver fatalities were examined.

To facilitate an understanding of the data presented and the limitations involved, some definitions must be presented:

Impaired: an impaired driver is one whose blood alcohol concentration (B.A.C.) level, was found to be greater than the legal limit of .08 mg.%.

Had Been Drinking (H.B.D.):	this term refers to drivers whose B.A.C. level was found to be positive (i.e., $\geq .01$).

All estimates of percentages of the population who were impaired or who had been drinking, assume that all dead drivers not tested had B.A.C.'s equal to zero. Thus, the percentages are *conservative* (minimum) estimates.

Table I, presents the age and sex distribution of the study group of young drivers. It is easily seen that males account for most of the fatalities, consisting of 91%, while females compose the other 9%. The majority of fatalities (54%) are between the ages of 18 and 21, with the peak existing among the 21 year olds.

The vehicles involved in the fatal traffic crashes are presented in Table II. Automobiles were most often involved for both age groups, representing 71% of the fatalities for 16 - 19 year olds and 68% of those for the 20 - 24 year old group. Some differences exist between the two age groups with respect to vehicles involved in the traffic crashes, when trucks, vans, and motorcycles are considered. The younger group of drivers were more often involved while driving motorcycles (15% versus 11%), while the older group were more often driving trucks or vans (17% versus 14%). When the two groups are further examined with respect to the hour of their fatal crashes (Table III), it can be seen that the hours between 8 p.m. and 6 a.m. produce the majority of the fatalities. Thus, 62% of the younger drivers and 59% of the older group had their crashes between those hours.

Alcohol involvement by age of the driver fatalities is presented in Table IV. *At least 51% of the young drivers had been drinking and 43% of those were impaired.* These figures are comparable to the national figures found by T.I.R.F.[1] for 1974-1975. The problem is clearer when the alcohol involvement is examined by the time the crash occurred. *At least 58% of young drivers in this sample were impaired when their crash occurred between the hours of midnight and 6 a.m. Furthermore, 69% of the drivers involved during these hours had been drinking.* These percentages are much higher than the means for this group over the full 24-hour period, i.e., 51% and 43%, respectively.

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[1] Simpson, H.M.; Warren, R.A.; Pagé-Valin, L., "Analysis of Fatal Traffic Crashes in Canada, 1974-1975, Focus: the impaired driver", TIRF Reports, February 1977, 29p.

The preliminary data presented here provide only an indication of the involvement of young drivers in fatal traffic crashes. Nonetheless, the situation is serious and warrants further consideration. At least two issues seem salient. (1) Alcohol appears to be a major factor and perhaps meaningful information should be incorporated into driver instruction courses. Or, if it exists already it is either ineffective, or those who are impaired never use the resources available. (2) At least half of the young drivers who died were not impaired. What errors they made needs to be studied as suggested in the section of this report dealing with future directions for research.

TABLE I

DISTRIBUTION BY AGE AND SEX,
YOUNG DRIVER FATALITIES IN FOUR PROVINCES,
1974-1975

Age	Male	Female	Total	(%)
<16	17	1	18	(04)
16	39	3	42	(09)
17	39	4	43	(10)
18	52	8	60	(13)
19	59	5	64	(14)
20	47	6	53	(12)
21	62	4	66	(15)
22	32	6	38	(09)
23	27	3	30	(07)
24	31	2	33	(07)
Total	405 (91)	42 (09)	447	(100)

TABLE II

DISTRIBUTION OF VEHICLES DRIVEN BY AGE-GROUPS (<16-19) (20-24), YOUNG DRIVER FATALITIES IN FOUR PROVINCES, 1974-1975

Age-Group	Automobiles (%)	Trucks, Vans (%)	Motorcycles (%)	N/R	Total
<16-19	162 (71)	31 (14)	33 (15)	1	227
20-24	150 (68)	38 (17)	25 (11)	2	220
Total	312 (70)	69 (15)	58 (13)	3	447 (100)

TABLE III

HOUR OF CRASH BY AGE-GROUP (<16-19) (20-24) YOUNG DRIVER FATALITIES IN FOUR PROVINCES, 1974-75

Hour of Crash	<16 - 19	20 - 24	Total
00-0600	87 (38)	81 (37)	168 (38)
0700-0900	9 (04)	19 (09)	28 (06)
0100-1500	28 (12)	33 (15)	61 (14)
1600-1900	44 (19)	36 (16)	80 (18)
2000-2300	55 (24)	49 (22)	104 (23)
N/R	4 (02)	2 (01)	6 (01)
Total	227 (100)	220 (100)	447 (100)

TABLE IV

ALCOHOL INVOLVEMENT IN YOUNG DRIVER FATALITIES FROM FOUR PROVINCES 1974-1975, BY AGE

Age	# Drivers (%)	# Tested (%)	HBD (%)	Impaired (%)
<16	18 (04)	12 (67)	8 (44)	6 (33)
16	42 (09)	35 (83)	19 (45)	15 (36)
17	43 (10)	36 (84)	24 (56)	18 (42)
18	60 (13)	51 (85)	25 (42)	19 (32)
19	64 (14)	55 (86)	42 (66)	38 (59)
20	53 (12)	46 (87)	33 (62)	27 (51)
21	66 (15)	53 (80)	35 (53)	29 (44)
22	38 (09)	30 (79)	14 (37)	13 (34)
23	30 (07)	26 (87)	12 (40)	11 (37)
24	33 (07)	27 (82)	16 (48)	14 (42)
Total	447 (100)	371 (83)	228 (51)	190 (43)

TABLE V

ALCOHOL INVOLVEMENT
YOUNG DRIVER FATALITIES FROM FOUR PROVINCES
1974-1975, BY HOUR OF CRASH

Hour of Crash	# Drivers (%)	# Tested (%)	HBD (%)	Impaired (%)
00-06	168 (38)	140 (83)	116 (69)	98 (58)
07-09	28 (06)	21 (75)	4 (14)	4 (14)
10-15	61 (14)	48 (79)	10 (16)	9 (15)
16-19	80 (18)	67 (84)	37 (46)	31 (39)
20-23	104 (23)	90 (87)	57 (55)	45 (43)
N/R	6 (01)	5 (83)	4 (67)	3 (50)
Total	447 (100)	371 (83)	228 (51)	190 (43)

ANNOTATED BIBLIOGRAPHY

The purpose of this bibliography is to provide readers with a guide to the relevant literature in the area of driver education. The emphasis of the bibliography is on literature published after 1960 which is concerned with the evaluation of the effectiveness of driver education. All articles in the general area of driver education will not, therefore, be referenced. However, the most important and/or critical ones will be included.

Whenever possible, the original article was consulted and the summary composed from it. Not all the articles or reports have been annotated; it was felt that if the article was not accessed directly, it would not be legitimate to annotate it. In addition, subjective articles or those only tangentially relevant to driver education research were not summarized.

The bibliography is presented in alphabetical form for ease of access. The annotations are not critical; they present in summary form, the purpose of the study, its basic methodology and the results which were obtained. In some instances, limitations to the results are also presented.

AARON, James E., LINDAUER, L.B. et al. *A Multivariate Study of Objectively Measured Driver Performance Factors of High School Students* (Using a Highway Systems Research Car), Souther Illinois University, (Sept. 1972a), 95p.

Examined the feasibility of developing an objective index of driver performance, and determining the level and range of performance of 85 graduates of driver education. The index, to be applied as a criterion for testing the value of demographic variables as predictors, was based on the construct that "an efficient driver possesses a low rate of control input per unit of time per total time". No generalizations are to be attempted from the study. Two nul hypotheses concerning the demographic variables were rejected: knowledge of identity of sex and the linear combination of all demographic predictor variables. Two indices of driver performance were derived: Vehicle Speed Factor and Vehicle Control Input Rate.

AARON, James E. SPURLOCK, T. et al. *A Correlational Study Between Self-Concept and Driver Performance in Post Driver Education Male and Female Students in Selected Southern Illinois High Schools (Using a Highway System Research Car)*, Southern Illinois University, Illinois, (Sept. 1972b), 85p.

Examined the relationship between driver performance measures and the individual self-concept of 50 graduates of driver education courses. Four nul hypotheses were rejected for the female students, which were related to self-satisfaction, over-confidence and aggressive behaviour. Their sample was biased since the students' scores on the self-concept scale were under the general norms.

AARON, James E. STRASSER, M.K. *Driver and Traffic Safety Education* The MacMillan Co., New York, (1966).

ALBERTA GOVERNMENT, *Transportation Safety for Albertans*, Alberta Transportation, (May 1976), 9p.

Leaflet prepared to present the goals and future areas of interest and research to the Department of Transportation Safety Branch. Developed primarily as a sequel to the report of the Alberta Task Force, it is concerned with driver education, problem drivers, speed, vehicle, roadway, accident investigation and research, and emergency medical services. The areas will be investigated to reach the goal of accident reduction in Alberta.

ALBERTA TASK FORCE ON HIGHWAY ACCIDENTS, *Report*, Province of Alberta, Report presented to the Minister of Social Services and Community Health, (September 1975), 254p.

One section is devoted to driver education, because of statements to the effect that there is a steady increase in accidents and deaths involving young drivers. On the premise that there must be a deficiency in their driving skills and attitudes, eight recommendations are presented, concerned with future driver education in Alberta.

AMERICAN AUTOMOBILE ASSOCIATION, Driver Education Proves Its Worth: Results of Driver Education Programs, Washington D.C. (1955).

AMERICAN AUTOMOBILE ASSOCIATION, Driver Education Reduces Accidents and Violations, Washington D.C., (1959).

AMERICAN AUTOMOBILE ASSOCIATION, Driver Education Reduces Accidents and Violations, Washington D.C., (1964).

AMERICAN AUTOMOBILE ASSOCIATION, Driver Research Projects, Washington D.C.: (March 1968), No. 3637, 8p.

List of suggested projects on various aspects of driver education, with accompanying list of methodological procedures important to research in this area.

AMERICAN DRIVER AND TRAFFIC SAFETY EDUCATION ASSOCIATION, Policies and Guidelines for Driver and Traffic Safety Education, Washington, D.C. (1974), 57p.

ASAI, M., INAYOSHI, H. Some Determinants of Safety Mindedness: The Attitudes of High School Students Toward Traffic Safety, Tokyo: Nihon University, Dept. of Psychology, (October 1973), 21p.

ASHER, J. William "Do Driver Training Courses Produce Better Drivers? An Alternative Hypothesis", Traffic Safety Research Review, Vol. 12, No. 1, (March 1968), pp. 2-6.

Attempts to find human variables that have a significant relationship with the decision to take or not to take driver education when such a course is available. Seventy variables were analysed and correlated with the decision, on a sample of 532 senior high school students. The variables found to be significant clustered around academic knowledge, intelligence, socio-economic status and socio-economically related activities.

ASHER, William and DODSON, Beverly "The Prediction of Automobile Accidents Following The Senior Year in High School", Behavioral Research in Highway Safety, Vol. 1, No. 3, (Fall 1970) pp. 180-195.

Study to determine which of 103 "socio-psychological" variables from Project TALENT were related to the criterion variable of having been involved, as a driver, in an accident with injury, or damage over $100.00 during the previous year. The correlations were done on 799 subjects. Results indicate that 22 variables for the males and 28 for the females were significantly related with the accident criterion. Driver training was of no value in predicting accident involvement.

ASHER, W. and DODSON. "Automobile Accidents in the Year Following High School: The Predictive Value of 377 Unobtrusive Variables", Behavioral Research in Highway Safety, Vol. 2, No. 2, (Fall 1971), pp. 107-122.

Study to determine which of 377 variables were related to the criterion of having had a significant accident in the past year. Also, to determine if students who elect to take driver education differ from those not taking it, when it is available: 7,996 subjects were studied, sexes being run separately. Results indicated that 40 variables for males and 34 for females were significant. Driver training was again found to be not able to predict accident involvement. The number of significant variables is less than expected by chance alone. Socio-economically related variables are the most important predictors of accident involvement.

ASSOCIATION OF CASUALTY AND SURETY COMPANIES Research on the Accident Reduction Value of High School Driver Education, New York, N.Y., (1955).

ATCHESON, B. and LANGFORD, N. "High School Driver Education in Canada", Summary prepared for the First National Symposium on Driver Education, Toronto, (October 1974), 29p.

Summary of the development of driver education and teacher training programmes in Canada, as of 1974. Also included is a table indicating the number of graduates of driver education in 1973-1974.

ATCHESON, Beth Evaluation Report of the First National Symposium on Driver Education, (May 1975), 7p.

BARBER, R. Jerry "Evaluation - Accountability Model for Driver Education", Journal of Traffic Safety Education, Vol. 20, No. 2, (October 1972), pp. 11-12.

Presentation of an "evaluation-accountability" model for driver education, concerned with curriculum development and evaluation, in terms of behaviorally defined objectives.

BARNES, D.H. and FLANIGAN, J. "A Critical Analysis of Driver Education Research", Traffic Safety Research Review, Vol. 2, No. 2 pp. 12-14.

BARNETT, Isaac "The Police Officer in the Driver Education Classroom", Traffic Safety, Vol. 73, No. 11, (November 1973), pp. 12-13.

BARRET, G.V. and ALEXANDER, R.A. Models of Driver Behaviour in Critical Situations: Implications for Licensing, Training, and Research, Akron University, Dept. of Psychology, (October 1973), 10p.

Summary of a report which was designed to determine the feasibility of developing techniques to (1) measure driver decision-making performance, (2) modify the relevant personal characteristics involved in decision making, through training and (3) evaluate the testing and training materials. The author did extensive reviews of literature and developed a classification-training-cost-benefit model. The report was accomplished in five phases, culminating into the formulation of a research program to develop tests, techniques and evaluation research.

BAUMAN, R. "A New Approach in Driver Training", California Highway Patrolman, Vol. 38, No. 11, (January 1975), pp. 4-5, 20, 23.

BISHOP, R.W. "Evaluating Simulator Instruction for Accomplishing Driver Education Objectives", Traffic Safety Research Review, Vol. 11, No. 1, (1967), pp. 12-17.

Examined the value of simulator instruction with regard to knowledge acquisition, attitude development and acquisition of driving skills. Four groups of 50 students were pretested on knowledge and attitudes, assigned to the treatment conditions (3 experimentals and 1 control group) and then retested on the same variables in addition to a road test for the three experimental groups (A. behind-the-wheel instruction; B. simulator instruction; C. driving range experience). Results indicate that simulator instruction had a significant effect on knowledge, but not on attitudes, and students in the simulator group demonstrated a better performance than a group with three hours of behind-the-wheel instruction and six hours of observation.

BISHOP, R.W. "A Curriculum Designed to Meet the Needs of the Seventies", Journal of Traffic Safety Education, Vol. 21, No. 3, (April 1974), pp. 7-10.

BISHOP, Richard W. "Research and Development" paper presented at the First National Symposium on Driver Education, (October 25, 1974), Toronto, 10p.

Examines how driver education has expanded in the United States, with a brief history and summary of evaluation research in the area. Also discusses Multiple Car Methods and the concept of Values Clarification.

BOULTON, J.B. "The Effectiveness of Driver Training", paper presented at the National Road Safety Symposium, Australian Department of Shipping and Transport, Canberra (1972), pp. 559-567.

BOYCE, L. and DAX, E.C. "Driver Education and Driving Offences in Young Males", Australian Road Research, Vol. 5, No. 7, (May 1975), pp. 24-43.

BRAZELL, R.E. A Comparison of Various Behind-the-Wheel Training Methods, Safety and Traffic Division, Automobile Club of Michigan (1962).

BRENT, George, H. "Program Design and Implementation", paper presented at the First National Symposium on Driver Education, (October 1974), Toronto, 6p.

Summary description and history of the implementation of driver education in Saskatoon. Position paper.

BURG, Albert "Characteristics of Drivers", Human Factors in Highway Traffic Safety Research, T.W. Forbes, (Ed.) New York: Wiley-Interscience (1972), pp. 74-94.

Chapter devoted to the identification of the characteristics of the driving population in general, to investigate what is known about their relationship with driving performance and to indicate, where possible, some implications. Some data on age, miles driven, sex, marital status, occupation and educational background are provided.

BURG, A. The Effects of Exposure to Risk on Driving Record, Final Report, Institute of Transportation and Traffic Engineering, California University, Los Angeles, (June 1973), 131p.

CALIFORNIA COMMITTEE FOR TRAFFIC SAFETY EDUCATION, The California Driver Training Evaluation Study: A Comparative Analysis (April 1975) 4p.

CALIFORNIA DEPARTMENT OF MOTOR VEHICLES "California Driver Training Evaluation Study, Final Report, Summary" The Veysey Study, State of California, (December 1973), 8p.

Study to compare the benefits and costs of Driver Training in California, as given in various formats by High School and Commercial School instructors. A random sample of school districts, schools and students was selected for study; 12,031 students completed the courses, with a drop-out rate of 20%. The major results concerning the effectiveness of driver education are that males have worse records and there are no differences between public or commercial courses in terms of citations or accidents. For immediate or intermediate criteria, commercially trained students are better. Cost-benefit analyses suggested that commercial school training was indicated because of the savings in cost that were found.

CAMERON, C., and MACDONALD, W.A. A Review of Driver/Rider Training in Relation to Road Safety, Expert Group on Road Safety, Melbourne (Australia), (1973), 80p.

CAMPBELL, B.J. "On the Role of Controversy" Journal of Safety Research, Letter to the Editor, Vol. 1, No. 4, (December 1969), pp. 146-147.

Attempts to interpret the studies and articles published by Goldstein and McGuire on the subject of Driver Education as to why the authors are opposed to one another. According to him, the authors agree that conclusions concerning the effectiveness of driver education cannot be made because no definitive research has been done. Alternative programs are advocated if the present ones are not found to be effective.

CAMPBELL, B.J. "Objective Programme Evaluation", *Proceedings of the Australian Road Research Board, Seventh Conference, Part 5. Road Safety, Visibility and Driver/Vehicle Studies, Victoria*, (1975), pp. 97-102.

CAMPBELL, D.T. and STANLEY, J.C. *Experimental and Quasi-experimental Designs for Research*, Chicago: Rand McNally College Publishing Company, (1963), 84p.

CANADA COUNCIL OF YOUNG DRIVERS, *High School Driver Education*, Draft Syllabus, Revised Edition, (August 1972), 299p.

High School Driver Education Draft Syllabus, prepared to upgrade and standardize such courses in Canada.

CANADA COUNCIL OF YOUNG DRIVERS, *Presentation to the Council of Ministers of Education*, Canada, (March 1974), 14p.

Paper devoted to the presentation of the views and opinions of the CCYD concerning the situation of driver education in Canada. Eight major problems are cited, including course evaluation. The recommendations are that driver education be made an elective credit subject and that it be upgraded and standardized.

CHAPMAN, Robert "Improving Driver-Licensing Programs", *Behavioural Research in Highway Safety*, Vol 1, No. 3, (Fall 1970), pp. 172-179.

Examines the problems associated with evaluating driver-licensing programmes, with a summary of the findings of a study group. Their recommendation is that a Planning-Feedback Change Plan be adopted because of its practicality and its potential for social change.

CLEARWATER, Harvey Etting *A Study of Certain Factors in the Fatal Traffic Accidents of 16 Year Old Drivers in Michigan, 1967-1969*, Abstract, (Unpublished Doctoral Dissertation), Michigan State University, (1970).

CONGER, John J. *Research in Driver Education*, Colorado University, (n.d.) 20p.

From a review of the major evaluation studies performed in the 1960's, the author concludes that the effectiveness of driver education has not been demonstrated. "Well-planned, scientifically controlled ways of investigating" driver education are seen as mandatory.

CONGER, J.J., MILLER, W.C. and RAINEY, R.V. "Effects of Driver Education: The Role of Motivation, Intelligence, Social Class and Exposure" *Traffic Safety Research Review*, Vol. 10, No. 3, (1966), pp. 67-71.

Examines the effectiveness of driver education in reducing responsible accidents, violations and violation points, of three groups of subjects. One (108) group completed a formal driver education course, one other (195) wanted to take a course but was not able to, and a third group (314) did not wish to take driver education. Their driving records were followed for four years. A first analysis indicated that such a course reduced the number of violations for the first group, compared to the two others. When other variables were controlled by matching 40 subjects in each group, this difference disappeared, but a significant difference in the number of accidents, favoring the first group, was found. The author concludes that potential contaminating factors must be controlled to evaluate driver education's effectiveness.

CONNECTICUT DEPARTMENT OF MOTOR VEHICLES, Driver Education Study, Hartford, Connecticut, (1974).

COPPIN, R.S., FERDUN, G.S., and PECK, R.C. The Teenage Driver, California Department of Motor Vehicles, Report No. 21, (February 1965).

CRABB, Owen "The Reality Crunch In Driver Education" Journal of Traffic Safety Education, Vol. 20, No. 1, (October 1972), pp. 31, 34.

Examines and defines the driving task to clarify the concept and provide new directions for driver education courses. The IPDE System is also introduced (Identify, Predict, Decide, Execute).

CRABB, Owen "An Intermediate Answer to the "Reality Crunch" in Driver Education - Part Two", Journal of Traffic Safety Education, Vol. 20, No. 2, (January 1973), 26p.

Second article on the IPDE System, describes the "Identify" section of this system.

CRANCER, A. An Evaluation of Driver Training Based on Accident and Violation Rates, Washington Department of Motor Vehicles, Olympia (1967), 11p.

Compares the effectiveness of high school driver education, commercial driver education, military training and informal training, in terms of the number of accidents and violations from January 1961 to May 1967. High school driver education was the most effective method and commercial training was better than informal training for drivers less than 21 years old. Military training was not found to be comparable because of the lack of driving experience of this group within the State of Washington.

DUNLAP AND ASSOCIATES INC. Driver Education and Training, DOT-FH-11-6559, Washington, D.C., National Highway Safety Bureau, (1968).

DUNN, Leroy Wilotha "The Development of an Instrument to Measure Knowledge of Traffic Concepts Found to Differentiate Between Violators and Non-Violators" Abstract, (Unpublished Doctoral Dissertation) Michigan State University, (1963).

A 110 item test to measure knowledge of traffic safety was developed and administered to 500 subjects. Group I consisted

of 233 violators (12 or more points in the last 24 months) and Group II consisted of 277 non-violators (licence renewal applicants, acquaintances of safety officers and respondents to a mailed questionnaire). Results indicate that 29 items differentiated between the two groups ($p \leq .15$), more individuals in the non-violators group answering correctly.

DUNN, L.W. "Where is driver education headed?" *Journal of Traffic Safety Education*, Vol. 22, No. 1, (October 1974), pp. 7-8, 14.

DUNN, P.J. "The Young Driver Seen Through the Eyes of a Young Driver", paper presented at the *National Road Safety Symposium*, Australian Department of Shipping and Transport (1972), pp. 380-383.

EMERY, Sister Marie Thérèse, o.p. *A Study of Certain Factors Related to the Patterns of Driving, Accident and Violation Rates of 436, 17 and 18 year-old licensed drivers from two Lansing Catholic Schools*, Abstract (Unpublished Doctoral Dissertation) Michigan State University, (1969).

Study to determine if a relationship exists between accident, violation rates and exposure variables and factors of age, sex and car-ownership. Data were gathered on 436 high school students, 17 and 18 years old, through questionnaires, personal interviews and the examination of the driving records of the students. Within the limitations of the study, a number of significant correlations were found. Major contributing factors as predictors of sex attributes, age and car-ownership were also identified.

FELL, J.C. *A Motor Vehicle Accident Causal System: The Human Element*, NHTSA (July 1974), 32p.

Presentation of a collision reporting system devoted to the human factors element, for the use of professional accident investigation research groups. The system is described, the findings of two studies are discussed and the implications and benefits of the system for driver education and training are presented.

FERDUN, G.S., PECK, R.C. and COPPIN, R.S. "The Teenage Driver: An Evaluation of Age, Experience, Driving Exposure and Driver Training as they Relate to Driving Record", *Highway Research Record*, No. 163, (1967).

FORBES, T.W. et al. *Driver Performance Measurement Research* Michigan State University, DOT-FH-11-7627, Washington, D.C. NHTSA, (1973).

GOLDSTEIN, L.G. "Research on Human Variables in Safe Motor Vehicle Operation: A Correlational Summary of Predictor Variables and Criterion Measures" *Driver Behavior Research Project*, George Washington University, (1961).

GOLDSTEIN, L.G. *Human Variables in Traffic Accidents: A Digest of Research and Selected Bibliography*, Highway Research Board, Bibliography 31., NAS-NRC, Washington, D.C. (1962), 8p.

Review of the literature concerned with human factors research. The major findings of research performed mostly before 1960 are presented and discussed. Five major areas are reviewed: driving

behaviour, psychomotor and sensory variables, cognitive measures, personality and societal measures, and alcohol. General conclusions are provided.

GOLDSTEIN, L.G. "Psychological Aspects of Traffic Accidents", *Traffic Digest and Review*, Vol. 12, No. 7, (1964), pp. 10-12.

GOLDSTEIN, L.G. "The 'Case' Against Driver Education", *Journal of Safety Research*, Vol 1, No. 4 (December 1969) pp. 149-164.

Reviews the study "An evaluation of Driver Education" by McGuire and Kersh. Two studies performed by the authors are found to be lacking in methodology and control of extraneous variables. The literature review by McGuire and Kersh is criticized, as are their conclusions which are stated as not being supported by facts. Goldstein concludes that the safety value of current programmes remains an unanswered question.

GOLDSTEIN, L.G. "On Science and Driver Education" Letter to the Editor, *Journal of Safety Research*, Vol 2, No. 1 (1970), pp. 7-12.

Response to Campbell and McGuire (in previous issue of *Journal of Safety Research*), on their conclusions about the effectiveness of driver education and the methodological problems associated with such research. Also discusses McGuire's comments pertaining to the definition of experimental research. Criteria for the evaluation of research are presented, as well as recommendations.

GOLDSTEIN, L.G. "Driver Education: A Review and Suggested Innovations", *Behavioural Research in Highway Safety*, Vol. 2, Nos. 1-2 (Spring and Fall, 1971), pp. 28-42.

Reviews various aspects of driver education, including its effectiveness in reducing accidents and violations, its rationale, and the methods for evaluating its effectiveness. The effectiveness of driver education cannot be ascertained from studies made previously, due to deficient methodological procedures. Since driver education can no longer be evaluated empirically in the USA, other directions must be followed.

GOLDSTEIN, L.G. "Youthful Drivers as a Special Safety Problem", *Accident Analysis and Prevention*, Vol. 4, No. 3 (September 1972), pp. 153-170.

Section of the article devoted to driver education and its relation to the accident and collision rates of graduates of the programme. Summary of a study by Harrington that was found to be very relevant.

GOLDSTEIN, L.G. *Behavioral Aspects of Highway Safety Relevant to Preparation of the Beginning Driver: A Review of Research*, Sacramento, California: California Traffic Safety Education Task Force, (1973).

GOLDSTEIN, L.G. *A Review of the California Driver Training Evaluation Study by Margaret Hubbard Jones*, prepared for the California Committee for Traffic Safety Education, (September 1974) 123p.

Re-analysis of the data used in the Veysey study, because of errors in calculations in opinion of the author, namely, analysis of both sexes together. The author analyzed background variables and driver records variables for follow-up periods of six months and one year. Results for the analysis of the male sample indicated that regular public courses are generally better than regular commercial courses in total record abstracts; when long courses are examined, results are mixed because some of the long courses are less effective than short programmes. Many limitations are presented for interpreting these data.

GOLDSTEIN, L.G. "The California Driver Training Evaluation Study; Rejoinder to Peck and Jones' Reply", *Journal of Traffic Safety Education*, Vol. 23, No. 1, (October 1975), pp. 7, 15-17.

Answers or discusses the points criticized by Peck and Jones, on the use of specific statistical tests, statistical theories and explains the reasons for his re-analysis. The author supports his previous findings.

GREEN, J.A. "The Relationship Between Traffic Violation Convictions and Traffic Accidents in Washtenaw County Michigan", *Hit Lab Reports*, Vol. 2, No. 11, (July 1972), pp. 7-8.

GREENSHIELDS, B.D. and PLATT, F. "Development of a Method of Predicting High-Accident and High-Violation Drivers", *Journal of Applied Psychology*, Vol. 51, No. 3 (1967), pp. 205-210.

Attempt to develop a method of predicting high-accident and high-violation driver; based on the postulate that drivers with different accident experience and driving records exhibit different driving profiles in ordinary driving situations. Four groups were tested: control group (N:40), high-accident group (N:40), high-violation group (N:20), beginning drivers (N:40). Results indicated that discrimination could be achieved between groups, and classification in the correct group could be obtained in 66% of the cases.

HADDON, W. Jr., SHUMAN, E.A., KLEIN, D. *Accident Research: Methods and Approaches*, New York: Harper & Row, (1964).

HARMAN, H., SEIBEL, D.W., ROSENFELD, M., and SHIMBERG, G. *Evaluation of Driver Education and Training Programs*, Washington, D.C.: Highway Research Board (1969) 117p.

Review, evaluation and recommendations pertaining to the four contract studies requested by NHTSA in 1968. The recommendations for the evaluation of driver education submitted by the contracted studies are reviewed and a total evaluative scheme is presented, with various criteria pertaining to: short-term, intermediate and long-term evaluations of the effectiveness of driver education.

HARRINGTON, David M. *An Evaluation of Waiving the Driving Tests for Selected Graduates of Driver Training*, Research Report 35, California Department of Motor Vehicles, Sacramento (June 1970), 9p.

> Pilot study to determine the feasibility of waiving the driving portion of the licensing procedure, for students in the highest 10% range, as determined by their driving instructors. A total sample of 2524 high school driver training students was compared to the 537 nominated students on: number of attempts to pass the test, delay time before licensing, number of hours of additional practice, etc. The nominated students had a passing rate of 85% (for those who took the test) compared to 73% for the other graduates. The number of hours of additional practice was significantly related to the passing rate, those having more than 15 hours, passing on the first trial in 90% of the cases. The percentages were considered too low for elimination of the driving test.

HARRINGTON, D.M. "The Young Driver Follow-up Study: an evaluation of the role of human factors in the first four years of driving", *Accident Analysis and Prevention*, Vol. 4, No. 3 (September 1972), pp. 191-240.

> Examines the relationship between driving records and biographical variables, after four years of driving (N:13,915). One section deals specifically with driver education. The students with behind-the-wheel training were found to have better accident and conviction records in the first year of driving, but no differences were found in subsequent years except for females after four years. Selection and volunteer biases were found to be greatly related to having fewer accidents and convictions. When adjusted statistically, females with driver education had reduced fatal and injury accidents, partially-at-fault accidents and single vehicle accidents. But these results cannot be accepted conclusively because of the limitations of the method employed (i.e. ex post facto).

HARTMAN, C.H. "*Research Challenges in Driver Education and Driver Licensing*" Washington, D.C., National Highway Traffic Safety Administration, (1971), pp. 9-16.

> Presents research challenges to improve the loss-reduction programme. Two central challenges are seen as the development of driver education and licensing programmes through research; eleven other challenges are seen as pertinent, related to which direction research should take, the acquisition of good research base, the development of specific objectives and driving task indices. Research is seen as the only way to realize important contributions.

HARTMAN, C.H., LAMBERT, O.F., LAVIOLETTE, L.E., LEUCH, P. MARQUART, J., ROCHE, M., SOLLOWAY, W.J., YAKSICH, S. Jr., papers presented at *The International Study Week in Traffic Engineering and Safety, 11th, Theme VII: Driver Education of Teenagers*, (1972), 27p.

HARTMAN, C.H. "Improved Driver Performance and Driver/Vehicle/Environment Interaction", *Journal of Traffic Safety Education*, Vol. 20, No. 2, (January 1973), pp. 7-8.

HATTERICK, G.R., BATHURST, J.R. *Accident Avoidance Skill Training and Performance Testing, Final Report*, (March 1976), 343p.

HELWIG, C. and PRINCE, C.W. "How Effective is Simulation?", *Traffic Safety*, Vol. 73, No. 2, (February 1973), pp. 24-25.

HENRY, J.P. "Studying the Road User", presented at *Symposium on Road Safety*, (1970), pp. 83-99, Salford University.

Discusses various research efforts related to the road user; discribes studies investigating normal driving behaviour, traffic conflicts, pedestrians, surveys of schools about their programmes in road safety; also discusses research on driver training and presents the results of experiments using the part-training method.

HUMAN RESOURCES RESEARCH ORGANIZATION *Administrative and Support Requirements for Implementing a Safe Performance Curriculum*, Draft, prepared for NHTSA - Department of Transportation, Contract DOT-HS-003-2-427, April 15, 1974.

JONES, M.H. "The Present Status of Curricula for Driver Instruction and Their Evaluation in the United States" *International Symposium on Psychological Aspects of Driving Behaviour*, (1971), 13p.

Summarily reviews evaluation research on driver education. Finds that present research efforts, although laudable, are not considering other variables concerned with learning. These variables were included in the California Driver Training Evaluation Study. The author describes the study and the learning variables that will be examined: length of learning session, interval between sessions, teacher-pupil ratio, teacher preparation and experience, teacher-student interaction.

JONES, M.H. "The California Driver Training Evaluation Study" *Journal of Traffic Safety Education*, Vol. 19, No. 3, (April 1972).

JONES, M.H. *California Driver Training Evaluation Study*, Final Report to the California Legislature, (December 1973) 422p.

JONES, M.H. "Long-Term Implications of the California Driver Training Evaluation Study", *Journal of Traffic Safety Education*, Vol. 21, No. 3, (April 1974), pp. 11-12, 26.

JONES, M.H. and COPPIN, R.S. "The California Driver Training Evaluation Study - A Reply to W.G. Patterson", *Journal of Traffic Safety Education*, Vol. 22, No. 4, (July 1975), pp. 7, 32.

KAESTNER, N. *Oregon High School Driver Education Study*, Dept. of Motor Vehicles, Salem, Oregon (1961-1962).

KAESTNER, N. "Research in Driver Improvement - the state of the art" *Traffic Quarterly*, Vol. 22, No. 4 (1968), pp. 497-520.

KAYWOOD, Richard "The Worth of Driver Education" (editorial) *Journal of Traffic Safety Education*, Vol. 20, No. 1, (October 1972), pp. 5, 14.

KELLEY, Albert Benjamin "Loss Reduction: New Dimensions for Driver Education" *Traffic Safety*, (June 1971), pp. 9-11, 38.

Discusses the problems associated with evaluation research on driver education; adopts the position of researchers and states that the effectiveness of the programme should be determined. But proposes that the driver education teacher experiment with new definitions and new approaches in the interim period before the effectiveness of driver education is ascertained. The approach proposed is one of total loss reduction.

KENNEDY, John "*Driver Education and Training Project*" Institute for Educational Development, New York, N.Y. (June 1968) DOT-FH-11-6561.

KENTUCKY DEPARTMENT OF EDUCATION, Bureau of Instruction, Frankfort "*Report of the Kentucky driver education program*", (1975), 103p.

KIMBALL, K.A., ELLINGSTAD, V.S., and HAGEN, R.E. "Effects of Experience on Patterns of Driving Skill", *Journal of Safety Research*, Vol. 3, No. 3, (September 1971), pp. 129-135.

> Evaluated the effects of driving experience on driving performance measured by a driving simulator. Tested were three groups: one group of experienced drivers, a group of novice drivers with more than ten hours of driving experience, and a second group of novice drivers with less than ten hours of driving experience. Results indicated that the more experienced drivers had better integrated the tasks of steering their vehicle and maintaining speed, while the novice drivers (< ten hours driving experience) had achieved control of the vehicle or control of speed, but had not integrated the two tasks. In fact, they tended to simplify the driving task by giving up speed control.

KING, D.C., & LEE, J.W. "Personality factors in driver education" *Traffic Safety*, Vol. 76, No. 3, (March 1976), pp. 18-19, 38.

KLEIN, D. "Countermeasures: What are we doing wrong?" in *Reducing Highway Deaths and Injuries*, Southern Newspaper Publisher Association, Atlanta (1972) P.H. Wright (Ed.), pp. 62-84.

> Presents new directions for the development of countermeasures, consistent with the philosophy that countermeasures are viable only if the characteristics of the populations in question, are known. Briefly discusses a concept of crash causation whereby the majority of crashes are attributed to slight decrements in human performance associated with slight increments in the demands of the task. Finally, evaluates the effectiveness of present countermeasures: punitive, restrictive, educational and modificative (vehicle design).

KOEHLER, Myron "The 'Goodness' of Driver Education" *Journal of Traffic Safety Education*, Vol. 21, No. 1 (October 1973), pp. 12, 42.

KROJ, G. "*Driver Education and Training*" Background paper for OECD Research Group SIO, OEC Paris, (1974).

LEIBOWITZ, Harold "Driver Education in New York City" *Journal of Traffic Safety Education*, Vol. 20, No. 1 (October 1972), pp. 13-14.

LEVONIAN, E., CASE, H.W., and WILSON, G.L. "Psychological Characteristics in Relation to Sex and Driving Experience of Driver Education Students", *Traffic Safety Research Review*, Vol. 6 No. 4, (1962), pp. 28-32.

LEVONIAN, Edward "Personality Characteristics of Juvenile Driving Violators", *Accident Analysis and Prevention*, Vol. 1, No. 1 (July 1969), pp. 9-16.

LICHT, Kenneth F. "Is Success Killing Driver Education", *Traffic Safety*, Vol. 73, No. 3 (March 1973), pp. 8-9, 39-40.

LINDAUER, L.B. *A Multivariate study of objectively measured driver performance factors of high school students (using a highway system research car)*. Southern Illinois University, Carbondale, Safety Center, (September 1972) 93p.

LOFT, B.I. "The Effect of Driver Education and Attitudes in Selected Public Secondary Schools", *Traffic Safety Research Review*, (June 1958), pp. 12-15.

LORENZEN, E.F.N. "Driving records as a criterion for teacher evaluation", *Journal of Traffic Safety Education*, Vol. 19, No. 4, (July 1972), pp. 25-26.

LYBRAND, W. et al. *A Study on Evaluation of Driver Education*, The American University, Washington, D.C., (August 1968), DOT-FH-11-6594.

LYLE, Kathryn *A Comparative Study of Traffic Violations of Selected Students in the Memphis City School System*, (March 1976), 36p.

> Evaluated the effects of driver education courses on the violation involvement of graduates of the course compared to that of drivers trained informally. The driving records of 1584 (792: driver education group; 792: non-driver education group) young drivers were examined over a five year period. Results indicate that the driver education group had substantially fewer violations and points than did the non-driver education group.

MANITOBA DEPARTMENT OF HIGHWAYS, "*Trained Driver vs. Untrained Driver*" High School Driver Education (1973), 5p. and personal communication.

> Study comparing the driving records of three groups of drivers: one group wanted to take driver education but wasn't able to, one group took driver education and one other did not wish to take it and did not take the course. The results of the comparisons indicated that of those who did not wish to take and did not take the course, 61.8% had some citation on their records compared to 38.5% of those who were unable to take the course and 24% for the group who took the course.

MAREK, J. and STEIN, T. "Driver Behaviour, Training and Traffic Environment" *Report No. 18*, from the Norwegian Committee on Traffic Safety Research, Oslo, (1971).

MAREK, Julius "Perspective on the Young Driver" presented at the *First National Symposium on Driver Education*, (October 1974), Toronto, 17p.

Dicusses various characteristics of the young driver, related to his high involvement in traffic crashes. Presents six areas potentially related to this involvement: exposure, experience, type and condition of the vehicle, personal characteristics, use of alcohol and driver education. Formal instruction is thought to be necessary, but within a mutually supportive system which takes into consideration all pertinent factors.

McDANIEL, Charles E. *A study to compare the relative effectiveness of selected laboratory and classroom programs in driver and traffic safety education*, Abstract (unpublished Doctoral dissertation, Michigan State University, E. Lansing) (1970).

McDOLE, T.L. *Evaluation of an improved driver education program for the Ann Arbor public schools*, HSRI, (March 1974), 39p. Report No. UM-HSRI-SA-74-5.

Study to determine if the "educational efficiency"of driver education increased with the introduction of a simulator. Four groups were tested on knowledge (A: before regular driver education; B: after regular driver education; C: before "improved" driver education; D: after "improved" driver education). Results indicated that significant differences favoring the "D" simulator group, existed in knowledge test scores, and that significant increases in simulator skills followed participation in improved driver education scores.

McDOLE, T.L. *"A Study to determine the feasibility of performing an evaluation of high school driver education in the State of Minnesota, final report"*, HSRI, (April 1974), 31p. Report No. UM-HSRI-SA-74-6.

Study to develop and eventually recommend an experimental design to evaluate driver education courses in Minnesota; also investigated the possibility of using driver records as criteria of the course's effectiveness. Provides an experimental design to evaluate the relative effectiveness of the programmes offered in Minnesota.

McFARLAND, R.A. and MOORE, R.C. "Youth and the Automobile" *Accident Research: Methods and Approaches*, W. Haddon, Sr., and D. Klein (Eds.) Harper & Row, New York, (1964), pp. 464-477.

McGUIRE, F.L. and KERSH, R.C. "The Relationship Between the Driver Attitude Scale and the McGuire Safe Driver Scale" *Traffic Safety Research Review*, (June 1964), pp. 57-59.

During the initial phases of a project designed to study accident prediction, one of the two tests was administered in a random fashion to 123 licence applicants to compare the tests. The author concludes that while the tests have some common factors, they tend to measure different aspects of driving attitudes.

McGUIRE, F. and KERSH, R.C. "An experimental evaluation of driver education" Unpublished manuscript, 1968. Abstract in *Traffic Safety Research Review*, Vol. 12, No. 4 (1968) 122p.

McGUIRE, F.L. and KERSH, R.C. "Study of history, philosophy, research, methodology, and effectiveness in the field of driver education", University of California Press, *Publication in Education*, Vol. 19 (1969).

General study on driver education, dealing with the effectiveness of the programme, and the methodological problems associated with such research. Three studies are also reprinted or published, two by the authors. It is concluded that "high school driver education bears no causal relationship to either traffic violations or accident frequency".

McGUIRE, Frederick L. "Driver Education at the Crossroads", *Caldea Calendar*, California Driver Education Association, Anaheim California, (January 1969).

McGUIRE, F. "In reply to Dr. Goldstein", *Journal of Safety Research* Vol. 4, No. 1 (Dec. 1969) pp. 165-169.

Reply to Goldstein's critiques of "An experimental evaluation of driver education". Provides other definitions of "experiment", presents further explanations of the Mississippi study and a study done by Thomas. Corrects misprints which occurred in the manuscript.

McGUIRE, F. "Smoking, Driver Education, and Other Correlates of Accidents Among Young Males", *Journal of Safety Research*, Vol. 4, No. 1, (March 1972) pp. 5-11.

Study to determine "true" and "quasi" predictors of accident and violation frequencies. Subjects were 2961 army recruits who had completed various questionnaires. Correlational analyses and multiple correlations were done between certain variables selected for study and the number of accidents reported by the subjects. Results indicated that the only "true" predictor variable was the value of the parents' home. No significant correlation was found between having taken driver education and a reduction in the subsequent collision involvement.

McGUIRE, F.L. "Psychological and Educational Methods of Influencing Driver Behaviour", presented at the *Symposium on Psychological Aspects of Driver Behaviour*, (1972) 16p.

Previous efforts to reduce collisions and violations by psychological and educational means are discussed. Reviews literature on the effectiveness of driver education and concludes that a cause-and-effect relationship cannot be ascribed to driver education with respect to accident and violation reduction. Driver behaviour modification is seen as potentially effective if improved methods are introduced. The author also considers it essential to test any driver modification technique before it is implemented.

McGUIRE, F.L. "The nature of bias in official accident and violation records", *Journal of Applied Psychology*, Vol. 57, (1973), pp. 300-305.

McGUIRE, F.L. "The effect of qualitatively different driver education programs on frequency of accidents and violations", California University, 14p. (no date).

> Compared the effectiveness of two driver education programmes, in two different high schools; programme "A" consisted of 30 hours of classroom instruction, programme "B", 30 hours of classroom instruction and ten hours of practical instruction (in-car and simulator). The graduates of the two programmes were interviewed (78% of A; 30% of B) on biographical information and involvement in accidents. The authors concluded that the two programmes were not different with respect to involvement in accidents or violations or the severity of the accidents of these groups. Further research is recommended.

McKNIGHT, A.J. "Developing and Evaluating a Secondary School Driver Education Curriculum for Safe Driving Performance", Journal of Traffic Safety Education, Vol. 20, No. 1 (October 1972), 25p.

McKNIGHT, A.J. "Evaluation of the Safety Performance Curriculum for Secondary School Driver Education", Journal of Traffic Safety Education", Vol. 20, No. 4, (June 1973).

McKNIGHT, A.J. "Needed Goals for Driver Education", Journal of Traffic Safety Education, Vol. 20, No. 2 (Jan. 1973), pp. 5-6.

McPHERSON, Kenard and MUNSUN, Robert "The Systems Approach Applied to Driver Education", Journal of Traffic Safety Education Vol. 18, No. 1 (Oct. 1970), pp. 17-18, 38.

MEIER, P. "The Biggest Public Health Experiment Ever: The 1954 Field Trial of the Salk Poliomyelitis Vaccine" in Statistics: A Guide to the Unknown, Judith M. Tanur (ed.), San Francisco: Holden-Day, Inc. (1972), pp. 2-13.

MOYNIHAN, D.P. "What the Moyniham Report Really said about Driver Education", Traffic Safety Research Review, (June 1968), pp. 24-25.

NÄÄTÄNEN, R. and SUMMALA, H. Road User Behavior and Traffic Accidents, New York: American Elsevier Publishing Company, Inc. (1976), 270p.

> Section of the book devoted to driver education reviews some methodological problems and recent investigations into the effectiveness of the programme. A section is also devoted to the young driver.

NATIONAL COMMISSION ON SAFETY EDUCATION Summary of results of studies evaluating driver education, Washington, D.C.: (1961).

NATIONAL EDUCATION ASSOCIATION, "A Critical Analysis of Driver Education Research, Washington, D.C. (1957).

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, The Driver Education Evaluation Program, (DEEP) Study, A report to the Congress, (July 1975), U.S. Department of Transportation.

> Examines the status of driver education as a countermeasure to the involvement of young drivers in traffic crashes and violations and some related formal instruction programmes aimed at crash involvement reduction (e.g. drinking drivers, motorcyclists, elderly drivers). Reviews the research designed to evaluate the effectiveness of driver education, and related efforts by NHTSA. A section is also devoted to estimating the impact of a nationally implemented programme, and recommendations are stated with respect to the future role of driver education as a "traffic safety countermeasure".

NATIONAL TRANSPORTATION SAFETY BOARD "Youth and Traffic Safety Education, Special Study", Abstract in Journal of Safety Research, Vol. 4, No. 1, March 1972, 43p.

NEW YORK DEPARTMENT OF MOTOR VEHICLES "An Evaluation of the Driving Records of High School Driver Education Students in New York State", Albany, N.Y., (1964).

NEW YORK UNIVERSITY, Evaluating the Effectiveness of Driver Education and Training, New York University, Centre for Safety, (May 1968) 116p.

> Contracted by NHTSA (then NHSB) to evaluate the effectiveness of driver education and develop plans for its evaluation. The authors found that the effectiveness of the programme could not be determined from previous research in the field. They propose an evaluation with random assignment of subjects to experimental conditions and the use of short-term, intermediate and long-term criteria.

OHIO DEPARTMENT OF EDUCATION, The Development and Validation of Attitude, Knowledge and Performance Tests for Evaluating Driver Education Curricula, (1974).

> Study to develop and validate objective tests and measures of knowledge attitudes and driver performance. The written tests were administered to an experimental group (enrolled in driver education) and a control group (not enrolled in driver education), while the driver performance test was administered only to a fraction of the experimental group. Results indicated significant differences between experimental and control groups on the post-knowledge test. No differences were found in the driving attitude tests.

OJEMANN, R.H. Tests and Evaluation Methods Used in Driver and Safety Education, National Commission on Safety Education, NEA, Washington, D.C. (1959).

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT Young Driver Accidents, OECD Road Research Group, Paris (1975), 192p.

> Investigates various aspects of the problem of the young driver.

In the chapter devoted to driver training, the major criterion measures of effectiveness are examined and the most important studies of effectiveness are reviewed. Some suggestions and proposals are also presented.

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT *Driver Instruction*, OECD Road Research Group, Paris (1976), 95p.

Report prepared to examine various aspects of driver instruction, primarily in terms of content and evaluative criteria (i.e. driver licensing procedures). One section is devoted to research and to the consideration of an analysis of the driving task; another is concerned with testing methods and a final section is devoted to a review of existing "driver instruction systems". Recommendations are included.

PAIN, Richard F., WHITTENBURG, J.A. et al. *Evaluation and Development of Driver Training*, American University, URS/Matrix Company, (Oct. 1973) 15p.

Study to evaluate driver training programmes and measuring instruments. Subjects were enlisted recruits who were matched on selected criteria and assigned to an experimental (driver improvement) and a control group. Both groups were pre-and post-tested. Results indicated that, on the basis of the ultimate criterion, i.e., accident reduction, no significant differences were found. But injuries were reduced substantially for the experimental group submitted to a classroom and driving range course.

PATTERSON, W.G. "The California Driver Training Evaluation Study-Fact or Fiction?" *Journal of Traffic Safety Education*, Vol. 22, No. 2 (January, 1975), pp. 7-8.

PEASE, Joseph, J., DAMRON, Frazier, C. "The Effectiveness of Video Tape Feedback on Driving Performance and Self-Evaluation", *Journal of Safety Research*, Vol. 6, No. 1, (March 1974), pp. 34-40.

PECK, R.C., McBRIDE, R.S. & COPPIN, R.S. "The Distribution and Prediction of Driver Accident Frequencies", *Accident Analysis and Prevention*, Vol. 2, No. 4 (1971), pp. 243-299.

PECK, R.C., JONES, M.H. "The California Driver Training Evaluation Study; a reply to Goldstein's critique and summary by the California Committee", *Journal of Traffic Safety Education*, Vol. 23, No. 1 (October 1975), pp. 7, 13-14.

Reply to Goldstein's reanalysis of the "California Driver Training Evaluation Study". The author's comment on the probability of finding significant differences when a great number of analyses are performed and the erroneous conclusion that all significant differences are real. A summary of the critique of the California Committee is also presented.

PELZ, D.C., SCHUMAN "What is the dangerous age for young drivers?" Traffic Safety, Vol. 70, No. 8 (August 1970), pp. 24-25, 35-36.

PELZ, D.C., SCHUMAN, S.H. "Are Young Drivers Really More Dangerous After Controlling for Exposure and Experience", Journal of Safety Research, Vol. 3, No. 2, (June 1971), pp. 68-79.

Study which investigated the involvement of young drivers in traffic crashes and violations, by examining the involvement of a sample of 3,000 drivers aged 16-24 and 35-44, and controlling for exposure and experience. Results indicated that age had a significant effect on involvement.

PELZ, D.C. and SCHUMAN, S.H. Countermeasures for young drivers: comparison among experimental groups over 18 months following treatment, Final Report, University of Michigan, Institute for Social Research and School of Public Health, (Oct. 1972), 123p.

PLANEK, T.W. "Driver Education Research in the United States - Can the New Directions be Supported?", Symposium on Psychological Aspects of Driver Behaviour, (1971), 18p.

Discusses research in-process in 1971 and its potential impact on driver education courses; specifically, research priorities are put on the analysis of the driving task. Reviews research dealing with this particular aspect, and some of the research evaluating the effectiveness of driver education. The author discusses the methodological problems associated with the latter type of research.

PLANEK, T.W. "Critical Issues Confronting Safety Research", Traffic Safety, Vol. 75, No. 9, (Sept. 1975), pp. 8-10, 34-35.

PLOUFFE, Jean-Pierre "The Instructor", paper presented at the First National Symposium on Driver Education, (October 25, 1974), Toronto, 8p.

PORTER, J.W. "Report of the Effectiveness of Current Driver Education Programs", Michigan Department of Education (1972), 15p.

Investigated the relative effectiveness of different types of driver education programmes. The criteria of effectiveness chosen were traffic accidents, accidents with injury, and violations. The study was made after the fact and no females were included in the sample. A number of limitations are presented and the conclusions of the study are thus seen only as indicators of possible relationships. Traditional courses (i.e. "30 and 6") are less effective and simulator programmes are most effective. But more definitive studies are needed.

QUANE, W. Laurance "What about an advanced driver education course?", Traffic Safety, Vol. 76, No. 1 (January 1976), pp. 20, 36-37.

RAINEY, R.W., CONGER, J.J. & WALSMITH, C.R. "Personality Characteristics as a Selective Factor in Driver Education", Highway Research Board Bulletin, No. 285, (1961).

RAYMOND, S. "An investigation of the influence of driver education on the driving behaviour of young people", Paper presented at a two-day symposium on Road Safety at the University of Salford, England, (1970), 25p.

Describes a study designed to evaluate the effectiveness of formal instruction. The programmes will be introduced into the regular curriculum, to control for volunteer or self-selection problems. The experimental group and the control group will each have approximately 900 students, and they will be tested on intermediate and ultimate criteria. The ultimate effectiveness of the programme will be ascertained by interviews, over a period of two or three years.

RAYMOND, S., JOLY, K.W., RISK, A.W., and SHAOUL, J.E. An evaluation of the Effectiveness of Driver and Traffic Education on Reducing Road Accidents Among Adolescents, Center for Transport Studies, Salford University, Salford, England, (1970), Abstract in Journal of Safety Research, Vol. 6, No. 3, (September 1974), 135p.

RAYMOND, S. & RISK, A.W. "Driver Education: Its Nature and Problems", Symposium on Psychological Aspects of Driver Education, (1971), 20p.

Discusses some objectives and assumptions of driver education courses, and some curriculum content. A section of the paper is devoted to the problems associated with evaluation research, through a review of the pertinent studies. The last portion of the paper describes the Salford Study (described in preceding article).

RAYMOND, S., RISK, A.W., SHAOUL, J.E. An Evaluation of Driver Education as a Road Safety Measure, presented at the International Conference on Driver Behaviour, Zurick (October 1973) 10p.

Presents some preliminary results of the Salford Study. Results on the short term effects indicated that post-test scores on the knowledge test favored the formally trained students; longer term effects (accidents) favored the students trained formally, on the basis of accidents per driver. But when exposure was controlled, no differences were found between the two groups.

RILEY, M.C., McBRIDE, R.S. "Safe Performance Curriculum for Secondary School Driver Education: program development, implementation and technical findings" by Human Resources Research Organization, (April 1975) Final Report, 270p.

A study designed to determine the relative effectiveness of the Safe Performance Curriculum, compared to a Pre-Driver Licensing Course. Students were invited to participate in the course, and then assigned randomly to the SPC, the PDL and a control group. The students were pre-and post-tested on knowledge and attitudes, and were administered road performance tests at completion of the courses. Results indicate that students in the Safe Performance Curriculum generally had higher scores than that of the students in the PDL. Recommendations are made for further refinements, as well as for a follow-up study.

RODELL, M.J. "A Comparison of Public and Private Driver Training Courses", Department of Motor Vehicles, Olympia, Washington, Report No. 023 (April 1969).

Study to investigate the relative effectiveness of public and commercial driver instruction, by comparing the driving records of the two groups. Results showed that males in commercial courses had significantly fewer accidents and convictions than did those in the public courses.

RUMSFIELD, W. "The Case for Multiple Standards in Driver Training" Proc. of the National Driver Education and Training Symposium, Sponsored by NHSB (Dec. 1968 - Jan. 1969).

Addresses the issue of education versus training, favoring the latter. Quotes Dr. Edward Tenney in "The Highway Jungle".

RUSSEL, I.F., "Driver Training for Present and Future Traffic Systems", SAE - Australasia, Vol. 32, No. 4, (Sept./Oct. 1972), pp. 158-164.

SCHLESINGER, L.E. "Objectives, methods and criterion tests in driver training", Traffic Safety Research Review, Vol. 11, No. 1, (1967b), pp. 18-24.

SCHUMAN, S.H., PELZ, D.C., EHRLICH, N.J. & SELZER, M.L. "Young Male Drivers: Impulse expression, accidents and violations" Journal of the American Medical Association, Vol. 200, (1967), pp. 1026-1030.

SCHUMAN, S.H., McCONOCHIE, R. & PELZ, D.C. "Reduction of Young Driver Crashes in a Controlled Pilot Study; Two-year follow-up in one Michigan High School", Journal of the American Medical Association, Vol. 218, No. 2, (1971), pp. 233-237.

Examined the countermeasure effectiveness of small group discussions followed by driving letters at six-month intervals, on the accident rate of a group of senior high school students. Their driving records were compared to those of a control group during a follow-up period of two years. The two groups (experimental: 19; control: 114) were randomly selected. Results indicated that the experimental group had lower accident rates but not at a significant level.

SEALS, Thomas A. "An Evaluation of Selected Driver and Traffic Safety Education Courses" (August 1966)

Study to determine the relative effectiveness of four types of formal instruction programmes in terms of knowledge and performance. Subjects (N:600) were randomly assigned to the four courses and pre-and post-tested on knowledge. The significant improvement in test scores after completion of formal instruction shown by all groups favored those with simulator instruction. The road test performance scores after the courses indicated that the programme with practical experience was the least effective.

SEALS, T.A. "Accountability in Driver Education" Journal of Traffic Safety Education, Vol. 19, No. 4 (July 1972).

SEALS, T.A. "Evasive drills have no place in driver education for beginners", Journal of Traffic Safety Education, Vol. 22, No. 1, (1974), pp. 25-26.

SHAPIRO, M.K. Toward Accident Reduction Innovations in Driver Education. Final Report, Purdue and Indiana State Highway Commission, (September, 1972), 287p.

SHIELDS, Joseph, B. "Outlook 70's: Driver Education" Proceedings of the Thirteenth Annual Conference of the A.A.A.M. (Oct. 1969), pp. 197-206.

SHIVELY, J.E. & ASHER, William "Characteristics of students who could not take and schools which did not offer driver education", Journal of Education Research, Vol 64, No. 4, (December 1970), pp. 185-189.

> Study to investigate, after the fact, if a relationship existed between not taking driver education because it was not available and a number of "sociopsychological" variables, and to investigate if schools not offering driver education had different characteristics. For the students, 18 variables clustering around socioeconomically related variables were significantly related to not taking driver education. The same kind of variables were found to be significantly related to not offering driver education courses.

SONDEL, Donald, P. "Why Doesn't Driver Education Work?" Guest Editorial in Journal of Traffic Safety Education, Vol. 21 No. 1 (October 1973), pp. 31-32.

STANDIFER, James W. "7 Critical Issues in Driver Education", Traffic Safety, Vol. 71, No. 8, (August 1971), pp. 18-20, 36.

STEWART, J.R. & CAMPBELL, B.J. The Statistical Association Between Past and Future Accidents and Violations, Chapel Hill, N.C. University of North Carolina, Highway Safety Research Center, (1972).

TARRANTS, W.E. "Current Research in Driver Education" Spec. Rep. No. 107, Highway Safety, HRB-NAS-NAE, Proceedings of the 2nd Western Summer Meeting, Salt Lake City (August 1969) Publication No. 309-01791-2 Washington, D.C. (1970).

> Reviews the results and recommendations of four studies contracted by the NHTSA in 1968, and a follow-up study which recommended short, intermediate and long term evaluations of the effectiveness of driver education, as well as the development of measuring instruments.

THYGENSON, A.L. "Values Clarification for Driver Education", Journal of Traffic Safety Education, Vol. 21, No. 4 (July 1974), pp. 7-8, 26.

UPTON, Don, "NSC Driver Education Status Report - Where are we headed?", Journal of Traffic Safety Education, Vol. 20, No. 2 (October 1972), 15p.

VERNON, R.J. & PHILLIPS, M.B. A Study of Public School Driver Education in Texas, Texama & M. University, Texas Transportation Institute, (1972).

VILARDO, F.J., BLUMENTHAL, J. & PLANEK, T.W. The Effects of the National Safety Council's Defensive Driving Course on Knowledge and Attitude, Chicago: National Safety Council, (1968).

> Study designed to determine the effectiveness of the Defensive Driving Course in terms of knowledge and attitude scores. Three groups of subjects were pre and post-tested: one group volunteered for and took the course, one group also volunteered for the course but were not able to take it and one other did not wish to take the course and did not. Results indicated that the group who had taken the DDC has significantly better scores. Six months after taking the course, attitude scores were not different, and after twelve months the knowledge test scores were no longer different.

WALLACE, Jean E. & CRANCER, Alfred Jr. "Licensing Examinations and their Relation to Subsequent Driving Record" Behavioural Research in Highway Safety, Vol. 2, No. 1 & 2, (Spring & Fall 1971), pp. 53-65.

WALLER, P.F. "How effective are driver education and re-education programs? Second in series of three articles on driver licensing." Traffic Safety, Vol. 76, No. 7, (July 1976), pp. 22-24, 37-39.

WARNER, W.L. "A Brief History of Driver Education", Journal of Traffic Safety Education, Vol. 19, No. 2, (January 1972).

WILLIAMS, J.D., LIU, P.H. Driving behavior of young driver education graduates in South Carolina, South Carolina University, Traffic and Transportation Center, Columbia, (1972), 38p.

WILLIAMS, James R. "Human Information Processing Can Aid Driver Education", ASSE Journal, (June 1969), pp. 6-10.

WILSON, W.T., LONERO, L. & BREZINA, E. "A Skills Improvement Approach to Collision Reduction", Canadian Psychologist, Vol. 14, No. 1, (January 1973), pp. 8-16.

WUERDEMANN, Belew, W.W., OVERBEY, J.W. & HORTON, W.F. Drivers in Fatal Crashes With and Without Driver Training, Final Report, (January 1976), 7p.

> Investigated the fatal crash involvements of drivers with and without formal instruction, and some related characteristics. The age distributions of the drivers with and without training were very different; comparison of prior convictions or suspensions showed no differences between the two groups, but when accident involvement

was investigated, it was found that drivers with formal instruction had a slightly higher percentage of accident-free records.

ZELLER, Anchard F. "The USAF's Multimedia Driver Training Program", Proceedings of the Eighteenth Conference of the AAAM, (Sept. 1974), pp. 408-416.

ZYLMAN, Richard "Evaluating Driver and Traffic Safety Education Programmes", Journal of Traffic Safety Education, Vol. 21, No. 1, (October 1973), pp. 7-8.

The use of driving records as criterion measures of effectiveness may not be valid because not all violations and collisions appear on the records. From a previous investigation of driving records it was concluded by the author that such measures are not valid because local policies and practices determine if a collision will be entered on record, or if a driver will be issued a violation. Thus, they are not intended for purposes of evaluation.

ZYLMAN, Richard "Drivers Records: Are they a valid measure of driving behaviour?", Accident Analysis and Prevention, Vol. 4 (1972), pp. 333-349.

Investigated policies and practices of various police agencies, department of motor vehicles and prosecution's offices. From these investigations, the author found that enforcement, collision investigation and prosecution practices were not consistent among jurisdictions.

ANONYMOUS "Crisis Conditioning - New Approach to Driver Training", Journal of American Insurance, Vol. 45, No. 4, (Sept. - Oct. 1969).

ANONYMOUS "New Trends in Driver Education" in Ontario Traffic Safety, Vol. 16, No. 2, (February 1973) 7p.